WARWICK MUNICIPAL BUILDINGS
ICE RINK AND SWIMMING POOL
WARWICK, RHODE ISLAND

FIRE ALARM AND SPRINKLER
UPGRADE PROJECT

Project Manual

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1.0 GENERAL

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1.2 CONTRACT DESCRIPTION

A. Work of the Project includes the installation of both an automatic sprinkler system and fire alarm system throughout the Warburton-Thayer Arena (975 Sandy Lane) and fire alarm system throughout the McDermott Swimming Pool (955 Sandy Lane).

B. Perform the Work of the buildings under a single Contract under a stipulated sum Contract with the Owner in accordance with the Conditions of Contract.

C. Project will be constructed under a single prime contract.

1.3 WORK BY CONTRACTOR

A. The Work under this Contract includes:
   1. Install new municipally connected analog-addressable fire alarm system throughout the Ice Rink (975 Sandy Lane) and Swimming Pool (955 Sandy Lane) buildings.
   2. Demolish and completely remove all existing fire alarm notification appliances, detection devices and control equipment, except the existing radio Masterboxes and associated wiring to the existing fire alarm control unit. Existing wiring and conduit shall be demolished and removed.
   3. Coordinate and provide monitoring of the new fire sprinkler system. Valves to be furnished by fire sprinkler contractor. Monitor modules and wiring to be provided by fire alarm contractor.

4. Coordinate and provide monitoring and/or control functions of all HVAC and emergency generators, as shown.
5. Install new addressable control modules at existing radio Masterbox. Masterbox shall report general alarm (Masterbox Zone 1) and main waterflow switch activation (Masterbox Zone 2) for 975 Sandy Lane and only general alarm (Masterbox Zone 1) for 955 Sandy Lane. Include additional programming and wiring to report fully to the Warwick Fire Department upon general alarm or main waterflow condition.
6. Install new automatic sprinkler system throughout the Ice Rink (975 Sandy Lane) building. Reuse existing 4-inch underground fire service main.
7. Provide miscellaneous fire protection piping and valving as shown on the Contract Documents including but not limited to a double check valve backflow preventer, check valves, flow switches and floor/zone control assemblies.
8. Provide miscellaneous fire alarm devices, appliances, and equipments as shown on the Contract Documents including but not limited control modules, monitor modules, protective fire alarm box covers, protective notification appliance covers, and weatherproof appliances.
9. Provide new chain-link fence enclosure for fire protection valves and riser assembly in the Ice Rink building. Included in the chain-link fence enclosure shall be a swinging chain-link door to provide access to fire protection valves for inspection, testing and maintenance.
10. All staging, hoisting, and scaffolding necessary to complete the scope of work, as shown on Contract Documents and detailed in this specification. Work includes coordination between trades of all staging, hoisting and scaffolding. Included in the work is installation of fire protection and fire alarm components above the Astro-Rink layer. Work above layer to be completed without complete removal of the Astro-Rink layer. Work includes removal of sections necessary to provide access above the layer to complete the work. Astro-Rink Layer shall be returned to original condition at no cost to the Owner. Any additional damaged sections of the Astro-Rink layer shall be returned to original condition at no cost to the Owner.
11. Work includes cutting, painting and patching of ceilings. Hard ceilings shall be returned to the original condition and to the satisfaction of the owner. The Contractor shall remove, store and reinstall all acoustic ceiling tiles removed for the completion of work. Any ceiling tiles damaged by the Contractor shall be replaced at no expense to the Owner. All sprinkler piping shall be concealed above existing ceilings except where noted on Contract Documents. Fire Alarm conduit shall be installed above finished ceilings where practical or as indicated on Contract Documents. Approved MC Cable may be used above accessible ceilings.
12. Work includes installing a new Honeywell fire network adapter in each building. Fire network adapter to be installed in location noted on Contract Documents. Work includes installing new CAT5e plenum cable from the existing network switch to the fire network adapter in each building. Twisted pair shall be run from fire alarm control unit to the fire network adapter in each building, per manufacturer's requirements. Contractor shall provide 24VDC to new fire network adapter.
13. Included in the scope of work is the programming of the fire alarm control unit and the Honeywell Enterprise Building Integrator. Included in the scope is the purchase of one (1) year of Honeywell Enterprise Building Integrator License Agreement for a total of 250 points (250 total for 955 and 975 Sandy Lane) for the City of Warwick.
14. Preparation of shop drawings, product data, calculations, record drawings, and close out documents in accordance with these Contract Documents.
15. Provide through-penetration firestopping to all penetrations of the building construction (e.g., walls, floors, ceilings, etc.).

16. Demolition and removal of all existing fire alarm control equipment, devices, and notification appliances, except existing radio Masterbox and associated wiring.
17. Testing of all new equipment as indicated in the Contract Documents.
18. All other items described in the Contract Documents.
19. **Deduct Alternate 1 –** Remove all pendent sprinklers below the Astro-Rink layer and associated fittings and piping, as shown on FP-A1.1 through FP-A1.3. Upright sprinklers above Astro-Rink layer to remain as shown. Installation of upright sprinklers and trim piping shall be in accordance with typical upright sprinkler detail.

1.4 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.5 OWNER SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner-reviewed Shop Drawings, Product Data, and Samples, to the Contractor.
   2. On delivery, inspect products jointly with the Contractor.
   3. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner-reviewed Shop Drawings, Product Data, and Samples.
   2. Receive and unload products at the site; inspect for completeness or damage jointly with the Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

1.6 USE OF PREMISES

A. Contractor shall have limited use of premises for construction operations as indicated on the Contract Documents.

B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Limits: Confine construction operations to areas indicated on Drawings by Contract limits.
   2. Owner Occupancy: Owner will occupy Project Site during construction
   3. Driveways and Entrances: Keep driveways loading areas and entrances serving premises clear and available to Owner, Owner’s employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of building entrances and driveways
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building during construction period.

1.7 CONTRACTOR USE OF PREMISES

A. Limit use of premises for Work and for construction operations, to allow for work by other Contractors.

B. Limit access to site as directed by Owner's Representative.

1.8 WORK RESTRICTIONS

A. On-site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7:00 a.m. to 3:00 p.m., Monday through Friday, except otherwise indicated.
   1. Weekend Hours: As approved by Owner in advance.
   2. Early Morning and nighttime Hours: As approved by Owner in advance.
   3. Hours for Utility Shutdowns: As approved by Owner in advance.
   4. Hours for Core Drilling and Saw Cutting: As approved by Owner in advance.
   5. Coordinate work during any limited work periods with Owner.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Engineer and Owner not less than 3 days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

1.9 WORK SEQUENCE

A. Construct the Work to accommodate the Owner's occupancy requirements. Coordinate the construction schedule and operations with the Owner and Engineer. It is expected that working area may vary throughout the week.

1.10 OWNER OCCUPANCY

A. The Owner intends for the building to be occupied throughout construction.

B. Cooperate with the Owner to minimize conflict, and to facilitate the Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

2.0 PRODUCTS

Not Used.

3.0 EXECUTION

Not Used.

END OF SECTION 01100

SECTION 01200 - PRICE AND PAYMENT PROCEDURES

1.0 GENERAL

1.1 SECTION INCLUDES

A. Cash or Quantity allowances.

B. Contingency allowances.

C. Schedule of values.

D. Applications for payment.

E. Warranty inspection retainage.

F. Sales tax exemption.

G. Change procedures.

H. Defect assessment.

I. Unit prices.

J. Alternates.

1.2 CONTINGENCY ALLOWANCES

A. The project does not include a contingency allowance.

1.3 SCHEDULE OF VALUES

A. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet

B. Submit Schedule of Values in duplicate, one copyrighted original and one copy, within fifteen (15) days after date of receipt of a Purchase Order from the City of Warwick, Purchasing Division.

C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Organize the Schedule of Values by trade and to reflect the general organization of the work. The Schedule of values and the Project Schedule must reflect each other in organization and break down.

D. Include in each line item, the amount of Allowances specified in this Section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

E. Include in the schedule of Values the following Specific Line Items:

1.02 Mobilization
1.03 Demobilization
1.04 Builder's Risk Insurance
1.05 Bond
1.06 Shop Drawings and Submittal
1.07 Scheduling
1.08 Preconstruction Survey
1.09 Daily Clean up in the building
1.10 Site Clean up
1.11 Safety Compliance
1.12 Monthly Progress Drawing updates
1.13 Dumpsters / Trash removal
1.14 Labor
1.15 Material
1.16 Testing Allowance
1.17 Contingency Allowance
1.18 Any other Allowances from the Bid Form
1.19 Warrantee Retainage
1.20 As built Drawings
1.21 Project Close out (Beyond As built Drawings)

F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.4 APPLICATIONS FOR PAYMENT

A. Submit each application on an original copyrighted AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet, accompanied by three (3) copies.
   1. Individually sign and notarize, and emboss with notary's official seal, the original and each of the three (3) copies.
   2. Applications not including original copyrighted AIA G702, and G703 Forms, will be rejected, and returned for re-submittal.
   3. Applications not properly signed and notarized will be rejected, and returned for re-submittal.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Provide one (1) hard copy and one (1) copy in disc form of the updated construction schedule with each Application for Payment submission.
   1. Provide a statement signed by the Contractor's firm principal certifying that there are no unidentified outstanding claims for delay.

D. Include with each monthly Application for Payment, following the first application, one (1) copy of the Certified Monthly Payroll Record for the previous month's pay period.

E. Payment Period: Submit at intervals stipulated in the Agreement.

F. Submit with transmittal letter as specified for Submittals in Section 01330.

G. Substantiating Data: When the Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with the Application for Payment:
   1. Record Documents as specified in Section 01780, for review by the Owner which will be returned to the Contractor.
   2. Affidavits attesting to off-site stored products.
   3. Construction progress schedules, revised and current as specified in Section 01330.

1.5 SALES TAX EXEMPTION

A. Owner is exempt from sales tax on products permanently incorporated in Work of the Project.
   1. Obtain sales tax exemption certificate number from Owner.
   2. Place exemption certificate number on invoice for materials incorporated in the Work of the Project.
   3. Furnish copies of invoices to Owner.
   4. Upon completion of Work, file a notarized statement with Owner that all purchases made under exemption certificate were entitled to be exempt.
   5. Pay legally assessed penalties for improper use of exemption certificate number.

1.6 CHANGE PROCEDURES

A. Submittals: Submit name of the individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time by issuing supplemental instructions on AIA Form G710

C. The Engineer may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required, and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within fifteen (15) days.

D. The Contractor may propose changes by submitting a request for change to the Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation, and a statement describing the effect on Work by separate or other Contractors. Document any requested substitutions in accordance with Section 01600.

E. Stipulated Sum Change Order: Based on Proposal Request, and Contractor's fixed price quotation, or Contractor's request for a Change Order as approved by Engineer.

F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute the Work under a Construction Change Directive. Changes in the Contract Sum or Contract Time will be computed as specified for a Time and Material Change Order.

G. Construction Change Directive: The Engineer may issue a directive, on AIA Form G713 Construction Change Directive signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in the Contract Sum or Contract Time. Promptly execute the change.

H. Time and Material Change Order: Submit an itemized account and supporting data after completion of the change, within the time limits indicated in the Conditions of the Contract. The Engineer will determine the change allowable in the Contract Sum and Contract Time as provided in the Contract Documents.

I. Maintain detailed records of work done on a Time and Material basis. Provide full information required for an evaluation of the proposed changes, and to substantiate costs for the changes in the Work. Submit form "Breakdown of Hourly Rates" attached at the end of this section.

J. Document each quotation for a change in cost or time with sufficient data to allow an evaluation of the quotation. Provide detailed breakdown of costs and estimates for labor and materials including a detailed breakdown for subcontractor's or vendor's Work. Include copies of written quotations from subcontractors or vendors.

K. Change Order Forms: AIA G701 Change Order.

L. Execution of Change Orders: The Engineer will issue Change Orders for signatures of the parties as provided in the Conditions of the Contract.

M. Correlation Of Contractor Submittals:
   1. Promptly revise the Schedule of Values and the Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum. Promptly revise progress schedules to reflect any change in the Contract Time, revise sub-schedules to adjust times for any other items of work affected by the change, and resubmit.
   2. Promptly enter changes in the Project Record Documents.

1.7 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct an appropriate remedy or adjust payment.

C. The defective Work may remain, but the unit sum will be adjusted to a new sum at the discretion of the Engineer.

D. The defective Work will be partially repaired to the instructions of the Engineer, and the unit sum will be adjusted to a new sum at the discretion of the Engineer.

E. The individual Specification Sections may modify these options or may identify a specific formula or percentage sum reduction.

F. The authority of the Engineer to assess the defect and identify a payment adjustment, is final.

G. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected products.

2.0 PRODUCTS (Not Used)

3.0 EXECUTION (Not Used)

END OF SECTION 01200

SECTION 01300 - ADMINISTRATIVE PROCEDURES

1.0 GENERAL

1.1 SECTION INCLUDES

A. Site administration

B. Construction progress schedules.

C. Coordination and project conditions.

D. Preconstruction meeting.

E. Site mobilization meeting.

F. Progress meetings.

G. Preinstallation meeting.

1.2 SITE ADMINISTRATION

A. Maintain a daily attendance log to include the names of all project employees and guests to the site. The log sheet or sheets must clearly indicate the Project Name, and the name of the General Contractor. Each line on the log should allow for the name of each employee, the employee's job title (use terminology used by prevailing wage job title), and the name of that employee's employer. Each guest signing the log should indicate a brief description of the reason for the visit, and that guest's employer or organization.

1.3 COORDINATION AND PROJECT CONDITIONS

A. Coordinate the scheduling, submittals, and the Work of the various Sections of the Project Manual to ensure an efficient and orderly sequence of the demolition elements.

B. Coordinate the completion and clean up of the Work of the separate Sections in preparation for Substantial Completion.

C. Coordinate access to the site for correction of defective Work and the Work not in accordance with the Contract Documents.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule in duplicate within 15 days after date of established notice to proceed for Engineer to review.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.

D. Submit a computerized chart with separate line for each major section of Work or operation, identifying first work day of each week.

E. Show complete sequence of construction activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

F. Indicate estimated percentage of completion for each item of Work at each submission.

G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by the Owner and under Allowances.

1.5 PRECONSTRUCTION MEETING

A. The Engineer will schedule a meeting after the City of Warwick, Purchasing Division, issues a Purchase Order to the Contractor.

B. Attendance Required: Owner, Engineer, and Contractor.

C. Agenda:
1. Execution of the Owner-Contractor Agreement.
2. Submission of the executed bond and insurance certificates.
3. Distribution of the Contract Documents.
4. Submission of a list of Subcontractors, a list of products, schedule of values, and a progress schedule.
5. Designation of the personnel representing the parties in the Contract, and the Engineer.
6. The procedures and processing of the field decisions, submittals, substitutions, applications for payments, proposal requests, Change Orders, and Contract closeout procedures.
7. Scheduling.

D. Record the minutes and distribute copies within two days after the meeting to the participants, with two copies to the Engineer, the Owner, the participants, and those affected by the decisions made.

1.6 SITE MOBILIZATION MEETING

A. The Contractor will schedule a meeting at the Project site prior to the Contractor's occupancy.

B. Attendance Required: The Owner, Engineer, Contractor, the Contractor's Superintendent, and major Subcontractors.

C. Agenda:
1. Use of the premises by the Contractor.
2. The Owner’s requirements and partial occupancy.
3. Construction facilities and controls provided by the Owner.
4. Temporary utilities provided by the Owner.
5. Security and housekeeping procedures.
6. Schedules.
7. Application for payment procedures.
8. Procedures for testing.
9. Procedures for maintaining the record documents.

D. Record the minutes and distribute the copies within two days after the meeting to the participants, with two copies to the Engineer, Owner, participants, and those affected by the decisions made.

1.7 PROGRESS MEETINGS

A. Schedule and administer the meetings throughout the progress of the Work at maximum monthly intervals.

B. Make arrangements for the meetings, prepare the agenda with copies for the participants, and preside at the meetings.

C. Attendance Required: The job superintendent, major subcontractors and suppliers, the Owner, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review the minutes of previous meetings.
2. Review of the Work progress.
3. Field observations, problems, and decisions.
4. Identification of the problems which impede the planned progress.
5. Review of the submittals schedule and status of the submittals.
6. Review of delivery schedules.
7. Maintenance of the progress schedule.
8. Corrective measures to regain the projected schedules.
9. Planned progress during the succeeding work period.
10. Coordination of the projected progress.
11. Maintenance of the quality and work standards.
12. Effect of the proposed changes on the progress schedule and coordination.
13. Other business relating to the Work.

E. Record the minutes and distribute the copies within two days after the meeting to the participants, with two copies to the Engineer, Owner, participants, and those affected by the decisions made.

1.8 PREINSTALLATION MEETING

A. When required in the individual specification Sections, convene a preinstallation meeting at the site prior to commencing the Work of the Section.

B. Require attendance of the parties directly affecting, or affected by, the Work of the specific Section.

C. Notify the Engineer four days in advance of the meeting date.

D. Prepare an agenda and preside at the meeting:
1. Review the conditions of installation, preparation and installation procedures.
2. Review coordination with the related work.

E. Record the minutes and distribute the copies within two days after the meeting to the participants, with two copies to the Engineer, Owner, participants, and those affected by the decisions made.

2.0 PRODUCTS

Not used.

3.0 EXECUTION

Not used.

END OF SECTION 01300

SECTION 01330 - SUBMITTAL PROCEDURES

1.0 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed products list.

D. Product data.

E. Shop drawings.

F. Samples.

G. Design data.

H. Test reports.

I. Certificates.

J. Manufacturer's instructions.

K. Manufacturer's field reports.

1.2 SUBMITTAL PROCEDURES

A. Master List Submittal:
   1. Submit a master list of the required submittals with a proposed date for each item to be submitted.
   2. Show the date submittal was sent, days since submittal was sent, status of submittal, date submittal was received in return, and any date associated with resubmittals.
   3. Update master list with each submission and response.
   4. Issue a copy of master list at least monthly to the Engineer.

B. Transmit each submittal with a dated Engineer-accepted transmittal form.

C. Sequentially number the transmittal form. Mark the revised submittals with an original number and a sequential alphabetic suffix.

D. Identify the Project, Contractor, Subcontractor and Supplier; the pertinent drawing and detail number, and the specification Section number, appropriate to the submittal.

E. Apply a Contractor's stamp, signed or initialed, certifying that the review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of the information is in accordance with the requirements of the Work and the Contract Documents.

1. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

F. Schedule submittals to expedite the Project, and deliver to the Engineer at their business address. Coordinate the submission of related items.

G. For each submittal for review, allow 15 days excluding the delivery time to and from the Contractor.

H. Identify the variations from the Contract Documents and the Product or system limitations which may be detrimental to a successful performance of the completed Work.

I. Allow space on the submittals for the Contractor and the Engineer review stamps.

J. When revised for resubmission, identify the changes made since the previous submission.

K. Distribute copies of the reviewed submittals as appropriate. Instruct the parties to promptly report an inability to comply with the Contract requirements.

L. Submittals not requested will not be recognized or processed.

M. Submittals Prepared Using Copyrighted AIA Forms:
1. Use only original copyrighted forms for the first typed copy of each submission. Do not use unauthorized duplications of copyrighted forms for the first typed copy.
2. Proceed to reproduce one or more copies of the first typed copy as may be required.
3. Copyrighted forms are those printed forms purchasable through an authorized outlet, or reproduced electronically under license from the AIA Electronic Document Service.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit preliminary outline Schedules within 15 days after the date of receipt of a Purchase Order from the City of Warwick, Purchasing Division for coordination with the Owner's requirements. After a review, submit detailed schedules within 15 days modified to accommodate the revisions recommended by the Engineer.

1. The Schedule shall be developed using Primavera or Suretrak.

B. Submit revised Progress Schedules, in both hard copy and in disc form, with each Application for Payment.

C. Distribute copies of the reviewed schedules to the Project site file, subcontractors, suppliers, and other concerned parties.

D. Instruct the recipients to promptly report, in writing, the problems anticipated by the projections indicated in the schedules.

E. Submit a computer generated horizontal bar chart with a separate line for each major portion of the Work or operation, or section of the Work, identifying the first workday of each week.

F. Show a complete sequence of construction by activity, identifying the Work of separate stages and other logically grouped activities. Indicate the early and late start, the early and late finish, float dates, and the duration.

G. Indicate an estimated percentage of completion for each item of the Work at each submission.

H. Provide a separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished Products and Products identified under Allowances, if any, and the dates reviewed submittals will be required from the Engineer. Indicate the decision dates for selection of the finishes.

I. Indicate the delivery dates for Owner furnished Products, and for Products identified under Allowances.

J. Revisions to Schedules:
   1. Indicate the progress of each activity to the date of submittal, and the projected completion date of each activity.
   2. Identify the activities modified since the previous submittal, major changes in the scope, and other identifiable changes.
   3. Provide a narrative report to define the problem areas, the anticipated delays, and impact on the Schedule. Report the corrective action taken, or proposed, and its effect.

K. If, in the opinion of the Engineer, the Contractor falls behind the progress schedule, the Contractor shall take any and all steps necessary to improve his progress at no additional cost to Owner, such as the following:
   1. Increase construction manpower in such quantities and crafts as will substantially eliminate the lag in schedule progress.
   2. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of construction equipment, or any combination of the foregoing, sufficiently to substantially eliminate lag in scheduled progress
   3. Reschedule sequence activities to achieve maximum practical concurrently accomplishment of work activities.

1.4 PROPOSED PRODUCTS LIST

A. Within 15 days after the date of receipt of a Purchase Order from the City of Warwick, Purchasing Division, submit a list of major products proposed for use, with the name of the manufacturer, the trade name, and the model number of each product.

B. For the products specified only by reference standards, give the manufacturer, trade name, model or catalog designation, and reference standards.

C. With each product listed, indicate the submittal requirements specified to be adhered to, and an indication of relevant "long-lead-time" information, when appropriate.

1.5 PRODUCT DATA

A. Product Data: Submit to the Engineer for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract

Documents. Provide copies and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01780.

B. Submit the number of copies which the Contract requires, plus two copies the Engineer will retain, but no less than a minimum of six (6) copies.

C. Mark each copy to identify the applicable products, models, options, and other data. Supplement the manufacturers' standard data to provide the information specific to this Project.

D. Indicate the product utility and electrical characteristics, the utility connection requirements, and the location of utility outlets for service for functional equipment and appliances.

E. After a review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01780.

1.6 SHOP DRAWINGS

A. Shop Drawings: Submit to the Engineer for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01780.

B. Indicate the special utility and electrical characteristics, the utility connection requirements, and the location of utility outlets for service for functional equipment and appliances.

C. Submit in the form of one reproducible transparency and one opaque reproduction.

D. Submit the number of copies which the Contract requires, plus two copies the Engineer will retain, but no less than a minimum of six (6) copies.

1.7 SAMPLES

A. Samples: Submit to the Engineer for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Produce duplicates and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01780.

B. Submit samples to illustrate the functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate the sample submittals for interfacing Work.

C. Include identification on each sample, with the full Project information.

D. Submit the number of samples specified in the individual specification Sections; the Engineer will retain one sample.

E. Reviewed samples, which may be used in the Work, are indicated in the individual specification Sections.

F. Samples will not be used for testing purposes unless they are specifically stated to be in the specification Section.

1.8 DESIGN DATA

A. Submit for the Engineer's knowledge as contract administrator, or for the Owner.

B. Submit for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.9 TEST REPORTS

A. Submit for the Engineer's knowledge as Contract administrator or for the Owner.

B. Submit test reports for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.10 CERTIFICATES

A. When specified in the individual specification Sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor to the Engineer, in the quantities specified for the Product Data.

B. Indicate that the material or product conforms to or exceeds the specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on the material or product, but must be acceptable to the Engineer.

1.11 MANUFACTURER'S INSTRUCTIONS

A. When specified in the individual specification Sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to the Engineer for delivery to the Owner in the quantities specified for Product Data.

B. Indicate the special procedures, and the perimeter conditions requiring special attention, and the special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

A. Submit reports for the Engineer's benefit as contract administrator or for the Owner.

B. Submit the report in duplicate within 30 days of observation to the Engineer for information.

C. Submit for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

2.0 PRODUCTS

Not Used.

3.0 EXECUTION

Not Used.

END OF SECTION 01330

SECTION 01400 – QUALITY REQUIREMENTS

1.0 GENERAL

1.1 SECTION INCLUDES

A. Quality control and control of installation.

B. Verification of Credentials and Licenses.

C. Tolerances

D. References.

E. Mock-up requirements.

F. Testing and inspection services.

G. Manufacturers' field services.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor a quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of the specified quality.

B. Comply with the manufacturers' instructions, including each step in sequence.

C. When the manufacturers' instructions conflict with the Contract Documents, request a clarification from the Engineer before proceeding.

D. Comply with the specified standards as a minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform the Work by persons qualified to produce the required and specified quality.

F. Verify that field measurements are as indicated on the Shop Drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 VERIFICATION OF CREDENTIALS AND LICENSES

A. The Owner has implemented a project management oversight process and is applying it to current construction project at the City of Warwick Municipal Buildings.

B. An element of this oversight process is the verification that persons employed on the project site have appropriate and current credentials and licenses in their possession, at the project site, for the work they are performing.

C. Verification of credentials and licenses of both union and non-union persons will be conducted during onsite inspections.

D. Contractor's Certified Monthly Payroll Records will be reviewed for conformance with RI State Prevailing Wage Rate requirements.

E. Those persons without the appropriate credentials and licenses will be subject to dismissal from the project site.

1.4 TOLERANCES

A. Monitor the fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with the manufacturers' tolerances. When the manufacturers' tolerances conflict with the Contract Documents, request a clarification from the Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.5 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by the date of issue current on the date of the Contract Documents, except where a specific date is established by code.

C. Obtain copies of the standards where required by the product specification Sections.

D. When the specified reference standards conflict with the Contract Documents, request a clarification from the Engineer before proceeding.

E. Neither the contractual relationships, duties, or responsibilities of the parties in the Contract, nor those of the Engineer, shall be altered from the Contract Documents by mention or inference otherwise in reference documents.

1.6 MOCK-UP REQUIREMENTS

A. Tests will be performed under the provisions identified in this Section and identified in the respective product specification Sections.

B. Assemble and erect the specified items with the specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. Where the mock-up has been accepted by the Engineer and is specified in the product specification Sections to be removed, remove the mock-up and clear the area when directed to do so by the Engineer.

1.7 TESTING AND INSPECTION SERVICES

A. The Contractor will submit the name of an independent firm to the Engineer for approval by the Owner, to perform the testing and inspection services. The Contractor shall pay for the services from the cash allowances specified in Section 01200.

B. The independent firm will perform the tests, inspections and other services specified in the individual specification Sections and as required by the Engineer.
   1. Laboratory: Authorized to operate in the location in which the Project is located.
   2. Laboratory Staff: Maintain a full-time registered Engineer on staff to review the services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either the National Bureau of Standards or to the accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off the project site. Perform off-site testing as required by the Engineer or the Owner.

D. Reports will be submitted by the independent firm to the Engineer and the Contractor, in duplicate, indicating the observations and results of tests and indicating the compliance or non-compliance with Contract Documents.

E. Cooperate with the independent firm; furnish samples of the materials, design mix, equipment, tools, storage, safe access, and the assistance by incidental labor as requested.
   1. Notify the Engineer and the independent firm 24 hours prior to the expected time for operations requiring services.
   2. Make arrangements with the independent firm and pay for additional samples and tests required for the Contractor's use.

F. Testing and employment of the testing agency or laboratory shall not relieve the Contractor of an obligation to perform the Work in accordance with the requirements of the Contract Documents.

G. Re-testing or re-inspection required because of a non-conformance to the specified requirements shall be performed by the same independent firm on instructions by the Engineer.

H. Payment for the re-testing or re-inspection will be charged to the Contractor by deducting the testing charges from the Contract Sum.

I. Agency Responsibilities:
   1. Test samples of mixes submitted by the Contractor.
   2. Provide qualified personnel at the site. Cooperate with the Engineer and the Contractor in performance of services.
   3. Perform specified sampling and testing of the products in accordance with the specified standards.

4. Ascertain compliance of the materials and mixes with the requirements of the Contract Documents.
5. Promptly notify the Engineer and the Contractor of observed irregularities or non-conformance of the Work or products.
6. Perform additional tests required by the Engineer.
7. Attend the preconstruction meetings and the progress meetings.

J. Agency Reports: After each test, promptly submit two copies of the report to the Engineer and to the Contractor. When requested by the Engineer, provide an interpretation of the test results.

K. Include the following:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

L. Limits On Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume any duties of the Contractor.
4. Agency or laboratory has no authority to stop the Work.

1.8 MANUFACTURERS' FIELD SERVICES

A. When specified in the individual specification Sections, require the material or Product suppliers, or manufacturers, to provide qualified staff personnel to observe the site conditions, the conditions of the surfaces and installation, the quality of workmanship, the start-up of equipment, or test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit the qualifications of the observer to the Engineer 30 days in advance of the required observations. Observer, subject to approval of Engineer.

C. Report the observations and the site decisions or instructions given to the applicators or installers that are supplemental or contrary to the manufacturers' written instructions.

D. Refer to Section 01330 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

2.0 PRODUCTS

Not Used.

3.0 EXECUTION

Not used.

END OF SECTION 01400

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

1.0 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating.
   4. Temporary cooling.
   5. Temporary ventilation.
   6. Telephone service.
   7. Facsimile service.
   8. Temporary water service.
   9. Temporary sanitary facilities.

B. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.

C. Temporary Controls:
   1. Security.
   2. Fire detection.
   3. Water control.
   4. Dust control.
   5. Erosion and sediment control.
   6. Noise control.
   7. Pest control.
   8. Pollution control.
   9. Rodent control.

D. Removal of utilities, facilities, and controls.

1.2 SUMMARY

A. This section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include the following:
   1. Division 1.
   2. Divisions 2 thru 16.

1.3 TEMPORARY ELECTRICITY

A. The Owner will pay the cost of energy used. Exercise measures to conserve energy. Utilize the Owner's existing power service.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Permanent building lighting may be utilized during construction.

1.5 TEMPORARY HEATING

A. Existing facilities shall be used.

1.6 TEMPORARY COOLING

A. Existing facilities shall be used.

1.7 TEMPORARY VENTILATION

A. Utilize the existing ventilation equipment. Extend and supplement the equipment with temporary fan units as required to maintain clean air for construction operations.

1.8 TELEPHONE SERVICE

A. Provide, maintain, and pay for a dedicated telephone service to the field office at the time of project mobilization.

1.9 FACSIMILE SERVICE

A. Provide, maintain and pay for a facsimile service, and a dedicated phone line, to the field office at the time of project mobilization.

1.10 TEMPORARY WATER SERVICE

A. The Owner will pay the cost of temporary water. Exercise measures to conserve water. Utilize the Owner's existing water system, extend and supplement with temporary devices as needed to maintain the specified conditions for construction operations.

1.11 TEMPORARY SANITARY FACILITIES

A. The existing designated facilities located within each building may be used during construction operations. Maintain daily in a clean and sanitary condition.

B. At the end of construction, return the facilities to the same or better condition as the original condition.

1.12 FIELD OFFICES AND SHEDS

A. A designated existing space within the building may be used for field offices upon approval of Owner.

1.13 VEHICULAR ACCESS

A. Construct temporary all-weather access roads from the public thoroughfares to serve the construction area, of a width and load bearing capacity to provide unimpeded traffic for construction purposes.

B. Extend and relocate vehicular access as the Work progress requires, provide detours as necessary for an unimpeded traffic flow.

C. Location as approved by the Owner.

D. Provide unimpeded access for emergency vehicles. Maintain 20-foot width driveways with turning space between and around combustible materials.

E. Provide and maintain access to fire hydrants and control valves free of obstructions.

F. Use designated existing on-site roads for construction traffic.

1.14 PARKING

A. Locate as approved by the Owner.

B. When site space is not adequate, arrange through the Owner for additional off-site parking.

C. Use of designated existing on-site streets and driveways for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.

D. Use of designated areas of existing parking facilities by construction personnel is permitted.

E. Do not allow heavy vehicles or construction equipment in parking areas.

F. Removal, Repair:
   1. Remove temporary materials and at Substantial Completion.
   2. Remove underground work and compacted materials to a depth of 2 feet; fill and grade the site as specified.
   3. Repair existing and permanent facilities damaged by use, to the original or specified condition.

1.15 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean the interior areas prior to the start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from the site periodically, weekly, or daily, as necessary to prevent an on-site accumulation of waste material, debris, and rubbish, and dispose off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.16 SECURITY

A. Security Program:
1. Protect the Work, the existing premises, or the Owner's operations from theft, vandalism, and unauthorized entry.
2. Initiate the program in coordination with the Owner's existing security system at the mobilization.
3. Maintain the program throughout the construction period until Owner occupancy.

B. Entry Control:
1. Restrict the entrance of persons and vehicles into the Project site, or the existing facilities.
2. Allow entrance only to authorized persons with the proper identification.
3. Maintain a log of workers and visitors, make available to the Owner on request.
4. Coordinate the access of the Owner's personnel to the site in coordination with the Owner's security forces.

1.17 FIRE DETECTION

A. Each day, before beginning any construction operations that can potentially trigger the existing fire alarm detection system, the Contractor is permitted to temporarily disconnect the system in the specific areas of construction, for as long as may be necessary. The Owner shall be notified each time the existing system is disabled.

B. Failure to so notify the Owner will subject the Contractor to a monetary fine for each occurrence, should the fire detection system be activated inadvertently by a construction activity.

1.18 WATER CONTROL

A. Grade the site to drain. Maintain excavations free of water. Provide, operate, and maintain the pumping equipment.

B. Protect the site from puddling or running water. Provide water barriers as required to protect the site from soil erosion.

1.19 DUST CONTROL

A. Execute the Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.

1.20 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize the amount of bare soil exposed at one time.

C. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect the earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.21 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by the construction operations.

1.22 PEST CONTROL

A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work, or entering the facility.

1.23 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent the contamination of soil, water, and the atmosphere from discharge of noxious, toxic substances, and pollutants produced by the construction operations.

1.24 RODENT CONTROL

A. Provide methods, means, and facilities to prevent rodents from accessing or invading the premises.

1.25 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials, prior to Substantial Completion.

B. Remove the underground installations to a minimum depth of 2 feet. Grade the site as indicated.

C. Clean and repair the damage caused by installation or use of temporary work.

D. Restore the existing [and the permanent] facilities used during construction to the original condition. Restore the permanent facilities used during construction to the specified condition.

2.0 PRODUCTS

Not Used.

3.0 EXECUTION

Not Used.

END OF SECTION 01500

SECTION 01600 - PRODUCT REQUIREMENTS

1.0 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

1.2 PRODUCTS

A. Products: Means new material, machinery, components, fixtures, or systems forming the Work; but does not include the machinery or equipment used for the preparation, fabrication, conveying, or erection of the Work. Products may include the existing materials or components required or specified for reuse.

B. Furnish products of qualified manufacturers suitable for the intended use. Furnish products of each type by a single manufacturer unless specified otherwise.

C. Do not use materials and equipment removed from the existing premises, except as specifically permitted by the Contract Documents.

D. Furnish interchangeable components of the same manufacturer for the components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with the manufacturer's instructions.

B. Promptly inspect shipments to ensure that the products comply with the requirements, the quantities are correct, and the products are undamaged.

C. Provide equipment and personnel to handle the products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect the products in accordance with the manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to the product.

D. For exterior storage of fabricated products, place on sloped supports above the ground.

E. Provide bonded off-site storage and protection when the site does not permit on-site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent the condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store the products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of the products to permit access for inspection. Periodically inspect to verify that the products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of the manufacturers named and meeting the specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify the time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.

B. Substitutions may be considered only when a product becomes no longer in production following the date of receipt of the Purchase Order for this Contract. Submit certification both that specified product was carried in Bid, and is no longer obtainable.

C. Document each request with complete data substantiating the compliance of a proposed Substitution with the Contract Documents.

D. A request constitutes a representation that the Bidder:
   1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the Substitution as for the specified Product.
   3. Will coordinate the installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse the Owner and the Engineer for review or redesign services associated with re-approval by the authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on the Shop Drawing or Product Data submittals, without a separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure, If Permitted Following Contract Award:
1. Submit three copies of a request for Substitution for consideration, no later than 20 working days following date of receipt of the Purchase Order for this Contract. Limit each request to one proposed Substitution.
2. Submit the Shop Drawings, Product Data, and the certified test results attesting to the proposed product equivalence. The burden of proof is on the proposer.
3. The Engineer will notify the Contractor in writing of a decision to accept or reject the request.

2.0 PRODUCTS

Not Used.

3.0 EXECUTION

Not Used.

END OF SECTION 01600

SECTION 01700 - EXECUTION REQUIREMENTS

1.0 GENERAL

1.1 SECTION INCLUDES

A. Examination.

B. Preparation.

C. Protection of adjacent construction.

D. Cutting and patching.

E. Special procedures.

F. Progress cleaning and waste removal.

G. Final cleaning.

H. Starting and adjusting of systems.

I. Demonstration and Instructions.

J. Testing, adjusting and balancing.

K. Protecting Installed Construction.

1.2 EXAMINATION

A. Acceptance of Conditions:
   1. Verify that existing applicable site conditions, substrates, or substrate surfaces are acceptable or meet specific requirements of individual specifications Sections, for subsequent Work to proceed.
   2. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
   3. Examine and verify specific conditions described in individual specifications Sections.
   4. Verify that utility services are available, of correct characteristics, and in correct locations.
   5. Beginning of new Work, that relies upon the quality and proper execution of Work of a preceding trade, means acceptance of that preceding Work as appropriate for the proper execution of subsequent Work.
   6. Acceptance of preceding Work that can be shown later to have adversely affected proper performance of new Work may result in removal and repeat performance of all Work involved at no cost to the Owner.

1.3 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply substrate primer, sealer, or conditioner, required or recommended by manufacturer, prior to applying any new material or substance in contact or bond.

D. Prior to the application, installation, or erection of any products and product components, perform any other preparatory operations, or surface or substrate modifications, as may be specified or directed by product manufacturers.

1.4 PROTECTION OF ADJACENT CONSTRUCTION

A. Protect existing adjacent properties and provide special protection where specified in individual Specification Sections.

B. Provide protective coverings at wall, projections, jambs, sills, and soffits of existing openings.

C. Protect existing finished floors, stairs, and other existing surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

D. Repair adjacent properties damaged by construction operations to original condition to the satisfaction of the Owner.

E. Prohibit unnecessary traffic from existing landscaped areas.

F. Restore grassed landscaped areas damaged by construction operations to full healthy growth, by installing loam and sod to the requirements, and under the supervision of, the Owner.

1.5 CUTTING AND PATCHING

A. Employ original, or skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements which affect:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual qualities of sight-exposed elements.
   5. Existing construction, or Work of separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute Work by methods that will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

E. Cut masonry, concrete, and other rigid materials using masonry saw or core drill.

F. Restore Work with new Products in accordance with requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. At penetration of fire resistance-rated partitions, ceiling, or floor construction completely seal voids with fire resistance-rated or fire resistant material in accordance with Section 07840, to full thickness of the penetrated element.

J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

K. Identify any hazardous substance or conditions exposed during the Work to the Engineer for decision or remedy.

1.6 SPECIAL PROCEDURES

A. Materials: As specified in product Sections; match existing with new products, or salvaged products as appropriate, for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to provide installation of new Work and finishes.

G. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring products and finishes to original or specified condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces to specified condition for each material, with a neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Engineer for review.

L. Where a change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition to Engineer for review.

M. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

N. Patch or replace portions of existing surfaces which are damaged, or showing other imperfections.

O. Finish the surfaces as specified in individual product Sections, or as indicated on the Drawings.

1.7 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site periodically or weekly and dispose of off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.8 FINAL CLEANING

A. Execute final cleaning of areas affected by the Work prior to final project assessment.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition using cleaning materials appropriate to the surface and material being cleaned.

D. Clean or replace filters of operating equipment as directed by Engineer.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.9 STARTING AND ADJUSTING OF SYSTEMS

A. Coordinate schedule for starting and adjusting of various equipment and systems.

B. Notify Engineer and Owner seven days prior to starting and adjusting of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute starting and adjusting under supervision of responsible Contractor's personnel or manufacturer's representative, in accordance with manufacturer's instructions.

G. Adjust operating Products and equipment to ensure smooth and unhindered operation.

H. When specified in individual specifications Section, require manufacturer to provide authorized representative to be present at the site to inspect, check, and approve equipment or system installation prior to starting, and to supervise placing of equipment or system in operation.

I. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.

1.10 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manuals with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled or agreed upon times, at equipment or system location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.11 TESTING, ADJUSTING, AND BALANCING

A. Submit, for the Owner's approval, the name of an independent firm to perform testing, adjusting, and balancing. The independent firm's services will be paid for by Change Order from a testing and inspection allowance specified in Section 01200.

B. The independent firm will perform services specified in individual specifications Sections.

C. Reports will be submitted by the independent firm to the Engineer and the Owner indicating observations and test results, indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

1.12 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Repair or replace installed Work damaged by construction operations, as directed by the Engineer.

2.0 PRODUCTS

Not Used.

3.0 EXECUTION

Not Used.

END OF SECTION 01700

SECTION 01780 - CLOSEOUT SUBMITTALS

1.0 GENERAL

1.1 SECTION INCLUDES

A. Substantial Completion

B. Closeout procedures.

C. Quality assurance.

D. Maintenance service.

E. Operations and maintenance manuals.

F. Materials and finishes manuals.

G. Equipment and systems manuals.

H. Spare parts and maintenance materials.

I. Product warranties and product bonds.

J. Project Record documents.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and the reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   9. Submit test/adjust/balance records.
   10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   11. Advise Owner of changeover in heat, cooling and other utilities.

12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer and Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete in completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 CLOSEOUT PROCEDURES

A. Submit a written certification that the Contract Documents have been reviewed, the Work has been inspected, and that the Work is complete in accordance with the Contract Documents and is ready for the Engineer's review.

B. Provide submittals to Engineer that are required by governing or other authorities, including abatement invoices correctly prepared as proscribed in Section 13280. Failure to include correctly prepared abatement invoices will delay issuing of final payment.

C. Provide submittals to Engineer that are required by the governing or other authorities, including the following closeout documents:
   1. AIA Document G706 - Contractor's Affidavit of Payment of Debts and Claims, 1994 Edition.
   2. AIA Document G706A - Contractor's Affidavit of Release of Liens, 1994 Edition.
   3. AIA Document G707 - Consent of Surety to Final payment, 1994 Edition.

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

E. The Owner will occupy all portions of the building as specified in Section 01100.

1.4 QUALITY ASSURANCE

A. Employ personnel assembling submittals experienced in the maintenance and the operation of the described products and systems.

1.5 MAINTENANCE SERVICE

A. Submit a contract for furnishing service and maintenance of the components indicated in the specification Sections for one year from date of Substantial Completion, or during the warranty period, whichever period of time is the longest.

B. Provide for an examination of the system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include a systematic cleaning, examination, adjustment, and lubrication of the components. Repair or replace the parts whenever required. Use the parts produced by the manufacturer of the original component.

D. Do not assign or transfer the maintenance service to an agent or Subcontractor without the prior written consent of the Owner.

1.6 OWNER'S MANUALS

A. Submit the data for Operations and Maintenance, Materials and Finishes, and Equipment and Systems Manuals bound in 8-1/2 x 11 inch text pages, in minimum 2 inch size three D side ring commercial quality binders with durable cleanable plastic covers.

B. Prepare binder covers with the printed title of the manual, title of the project, and the subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with the text; fold the larger drawings to the size of the text pages.

E. Submit two copies of a preliminary draft of the proposed formats and outline of the contents before the start of work. The Engineer will review drafts and return one copy with comments.

F. Submit one copy of the completed volumes 15 days prior to final inspection for final review. This copy will be reviewed and returned after final inspection, with the Engineer's comments. Revise the content of the document sets as required prior to final submission.

G. Submit two sets of revised final volumes in final form within ten days after final inspection.

1.7 OPERATIONS AND MAINTENANCE MANUALS

A. Contents: Prepare the Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing the names, addresses, and telephone numbers of the Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions arranged by system and subdivided by the specification Section. For each category, identify the names, addresses, and telephone numbers of the Subcontractors and suppliers. Identify the following:
      a) Significant design criteria.
      b) List of equipment.
      c) Parts list for each component.
      d) Operating instructions.
      e) Maintenance instructions for equipment and systems.
      f) Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a) Shop drawings and product data.

b) Air and water balance reports.
c) Certificates.
d) Originals of warranties and bonds.

1.8 MATERIALS AND FINISHES MANUALS

A. Building Products, Applied Materials, and Finishes: Include product data, with the catalog number, size, composition, and the color and texture designations. Include information for re-ordering custom manufactured products.

B. Instruction for Care and Maintenance: include manufacturer's instructions for cleaning agents and methods, precautions against detrimental agents and methods, and a recommended schedule for cleaning and maintenance.

C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

D. Additional Requirements: As specified in the individual product specification Sections.

E. Include a listing in the Table of Contents for design data, with a tabbed flysheet and a space for the insertion of data.

1.9 EQUIPMENT AND SYSTEMS MANUALS

A. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit documents within 10 days after acceptance.

B. Each Item of Equipment and Each System: Include a description of the unit or system, and the component parts. Identify the function, normal operating characteristics, and limiting conditions. Include performance curves, with Engineering data and tests, and complete nomenclature and model number of replaceable parts.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications by label machine.

D. Include color-coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Include a servicing and lubricating schedule, and a list of lubricants required.

H. Include the manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by the controls manufacturer.

J. Include the original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Include control diagrams by the controls manufacturer as installed.

L. Include the Contractor's coordination drawings, with color-coded piping diagrams as installed.

M. Include charts of valve tag numbers, with the location and function of each valve, keyed to the flow and control diagrams.

N. Include a list of the original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports as specified in Section 01400.

P. Additional Requirements: As specified in the individual product specification Sections.

Q. Include a listing in the Table of Contents for design.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in the quantities specified in the individual specification Sections.

B. Deliver to the Project site obtain a receipt prior to final payment.

1.11 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by the responsible subcontractors, suppliers, and manufacturers, within 10 days after the completion of the applicable item of work.

B. Execute and assemble the transferable warranty documents and bonds from the subcontractors, suppliers, and manufacturers.

C. Verify that the documents are in the proper form, contain full information, and are notarized.

D. Co-execute the submittals when required.

E. Include a Table of Contents and assemble in a three D side ring binder with a durable plastic cover.

F. Submit prior to the final Application for Payment.

G. Time of Submittals:
   1. For equipment or component parts of equipment put into service during construction with the Owner's permission, submit the documents within 10 days after acceptance.
   2. Make other submittals within 10 days after the Date of Substantial Completion, prior to the final Application for Payment.

3. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty or bond period.

1.12 PROJECT RECORD DOCUMENTS

A. Maintain on the site one set of the following record documents; record actual revisions of the Work for all trades:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instructions for assembly, installation, and adjusting.

B. Ensure the entries are complete and accurate, enabling future reference by the Owner.

C. Store the record documents separate from the documents used for construction.

D. Record information concurrent with the construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product Section description of the actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record the actual construction including:
   1. Measured horizontal and vertical locations of the underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Measured locations of internal utilities and appurtenances concealed in the construction.
   3. Field changes of dimension and detail.
   4. Details not on the original Contract drawings.

G. Legibly marked Specifications, and legibly marked Record Drawings and Shop Drawings shall constitute the Project Record Documents in paper form.

H. At completion of the Work of the Contract, the Engineer will furnish the Contractor a disc, or discs, containing the construction drawings in AutoCAD 2010 form, and the Project Manual content in Microsoft Word form.

I. Transfer the information from the Project Record Documents in paper form to the disc, or discs, and return to the Engineer along with the Project Record Documents in paper form. The disc, or discs, will constitute the Project Record Documents in digital form.

J. The Engineer will review the Project Record Documents and compare them for accuracy, and if necessary return them to the Contractor for final correction. At the time of final submission, submit a claim for the final Application for Payment.

K. Abatement Invoices: Application for Payment must be accompanied with shipping documents for disposal of the abated material as specified in Section 13280.

L. No review or receipt of record of Project Record Documents by the Engineer or the Owner shall be interpreted as a waiver of any deviation from the Contract Documents or Shop Drawings, or in any way relieve the Contractor from responsibility to perform the Work in accordance with the Contract Documents and the Shop Drawings to the extent they are in accordance with the Contract Documents.

M. Update the on-site Project Record Documents on a regular basis. Monthly payments will not be processed if Project Record Documents are not maintained up to date.

2.0 PRODUCTS

Not used.

3.0 EXECUTION

Not used.

END OF SECTION 01780

SECTION 07840 - THROUGH-PENETRATION FIRESTOPPING SYSTEMS

1.0 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work under this specification consists of the furnishing of all labor, materials, equipment, and services necessary for, and incidental to, the complete and proper installation of Underwriter's Laboratories, Inc. (UL) listed firestopping materials, systems, and/or devices for through-penetrations of fire-resistance rated assemblies, and smoke barriers.

1.2 QUALITY ASSURANCE

A. Firestop system installation shall be performed by a firm acceptable to the firestopping material manufacturer.

B. Products, execution, and firestop systems shall conform to the applicable code requirements for the required fire-resistance ratings.

C. All firestopping materials shall be listed as a product by the manufacturer under the appropriate category for the intended use by Underwriter's Laboratories, Inc. (UL) and shall bear the "UL" label, or nationally recognized testing laboratory (NRTL).

D. All firestopping materials shall be new and unused.

E. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner.

1.3 SCOPE OF WORK

A. The scope of work includes the complete and proper installation of UL Listed firestopping materials, systems, and/or devices for the buildings associated with this Contract.
   1. Through-penetrations of fire-resistance rated floor and roof construction associated with the new fire alarm system or sprinkler system installation.
   2. Through-penetrations of fire-resistance rated walls and partitions associated with the new fire alarm system or sprinkler system installation.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. The Firestopping Contractor shall furnish all labor, materials, equipment, and services necessary for, and incidental to, the complete and proper installation of all UL Listed firestop systems described in Section 1.3.

B. The Firestopping Contractor shall sequence and coordinate the installation of all firestop systems with other trades to ensure efficient installation of all firestop systems.

C. The Firestopping Contractor shall coordinate construction and cutting of openings so that each particular firestop system may be installed in accordance with its listing, including sizing, sleeves, and penetrating items.

D. The Firestopping Contractor shall maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install firestop systems under environmental conditions outside manufacturer's absolute limits.
E. The Firestopping Contractor shall provide ventilation as required by firestopping material manufacturer, including mechanical ventilation if required.

1.5 QUALIFICATION OF BIDDERS

A. Installer Qualifications: A firm specializing in installation of firestop systems similar to those required for this project with a minimum of five (5) years of successful documented experience. The installer must also be licensed installer by the firestopping material manufacturer.

1.6 CODES AND STANDARDS

A. Rhode Island Fire Safety Code
B. Rhode Island State Building Code
C. All materials shall be listed for the intended use in Underwriters Laboratories, Inc. (UL), UL FRD Fire Resistance Directory.
D. If a UL listing for a specific device is unavailable, approval by FM Global (FM) or other nationally recognized testing laboratory (NRTL) acceptable to the City of Warwick shall be acceptable.
E. American Society for Testing and Materials (ASTM):
    1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
    2. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials
    3. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops
    4. ASTM E 1399 - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
    5. ASTM E 1529 - Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies
    6. ASTM E 1725 - Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components
F. UL 1479 - Standard for Fire Tests of Through-Penetration Firestops
G. ANSI/UL 2079 - Tests for Fire Resistance of Building Joint Systems
H. Additional requirements of the Authority Having Jurisdiction (AHJ).

1.7 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary, apply to this Section.

1.8 ORDER OF PRECEDENCE

A. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply; however, should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:
    1. State and local codes shall take precedence over this specification.
    2. The National Fire Protection Association Standards shall take precedence over this specification.
    3. This specification shall take precedence over the drawings

1.9 FIRESTOP SYSTEM PERFORMANCE CRITERIA

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
   1. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection rated openings.
   2. Fire-resistance-rated floor assemblies.
   3. Fire-resistance-rated roof assemblies.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   1. Penetrations located outside wall cavities.
   2. Penetrations located outside fire-resistive shaft enclosures.
   3. Penetrations located in construction containing fire-protection-rated openings.
   4. Penetrating items larger than 4-inch- (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
   3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

F. Through Penetration Firestop System For Electrical Penetrations: Provide firestop systems complying with UL system No.5, R11044, tested in accordance with UL 1709, ASTM E 119, ASTM E 1529, and ASTM E 1725.

1.10 SUBMITTALS

A. Refer to Division 1 for the exact quantity of submittals required.

B. Shop Drawings: For each different firestop system configuration, provide the following:
   1. Listing agency's detailed drawing showing opening, penetrating items, and firestopping materials, identified with listing agency's name and number or designation, fire rating achieved, and date of listing.

2. Identify which rated assembly each system is to be used in.
3. Any installation instructions that are not included on the detailed drawing.
4. For proposed systems that do not conform strictly to the listing, submit listing agency's drawing marked to show modifications and stamped approved by firestop system manufacturer's fire protection engineer.
5. Submit listing agency's test report showing compliance with requirements, based on testing of current products.

C. Product Certificates: Submit certificates signed by firestop system manufacturer certifying that materials furnished comply with requirements.

D. Product Data: Manufacturer's data sheets on each material to be used in firestop systems, including:
1. Product characteristics and Material Safety Data Sheets.
2. Listing numbers of systems in which each product is to be used.
3. Preparation instructions and recommendations.
4. Storage and handling requirements and recommendations.
5. Installation methods.

E. Installer's Qualification Documentation.

1.11 WARRANTY

A. The Contractor shall guarantee all material installed free from defects in workmanship and inherent mechanical defects for a period of one (1) year from the date of substantial completion of the project.

B. Upon completion of the installation of all firestop systems, the Contractor shall provide a signed written statement, substantially in the form as follows:

C. The warranty period will begin on the date of substantial completion of the project.

1.12 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products until ready for installation in manufacturer's original unopened packaging, legibly marked with manufacturer's name and product identification, date of manufacture, lot number, shelf life, listing agency's classification marking, curing time, and mixing instructions if applicable.

B. Store and handle in such a manner as to prevent deterioration or damage due to moisture, temperature changes, contaminants, and other causes; follow manufacturer's instructions.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local AHJ.

1.13 DEFINITIONS

A. Construction Gap: An open joint between adjacent rated assemblies; may be a moving joint or static opening, without penetrating items.

B. Firestop System: Specific firestopping material or materials, which when installed in openings in a specific rated assembly, achieve the performance required.

C. Firestop: Result of installation of firestop system.

D. Listing: The current, published listing of a system in a NRTL agency's directory.

E. Penetrating Item: Any item (pipe, duct, conduit, cable, etc.) that passes completely through a rated assembly through an opening of any size.

F. Rated Assembly: A wall, floor, roof/ceiling, or other construction, which is required to have an hourly fire rating or a smoke resistance rating.

G. Through Penetration: A hole through a rated assembly made to accommodate the passage of a penetrating item or an empty hole made for another purpose and not repairable using the original materials of construction.

2.0 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer's:

1. 3M Fire Protection Products, Inc, St. Paul, MN
2. Nelson Fire Stop, Tulsa, OK
3. Hilti, Tulsa, OK
4. Johns Manville, Denver, CO
5. Tremco, Cleveland, OH
6. The Rectorseal Corp., Houston, TX
7. Specified Technologies Inc., Somerville, NJ

B. Single Source: All instances of a specific firestop system shall be made using products of the same manufacturer.

2.2 MATERIALS

A. Sealants,

B. Mortar,

C. Compound,

D. Putty, putty pads, and inserts,

E. Compounds,

F. Spray mastics,

G. Intumescent wrap strips and collars,

H. Firestop pillows and collars,

I. Cable and joint spray,

J. Forming materials.

2.3 ALL FIRESTOPPING MATERIALS

A. Listing Agency: Provide systems that are listed by at least one the following:
   1. Underwriters Laboratories Inc. (UL), in "Fire Resistance Directory" category XHEZ or XHBN as appropriate.
   2. Any other qualified independent testing and inspection agency that conducts periodic follow-up inspections and is acceptable to authorities having jurisdiction.
      a. Furnish products identical to those tested for classification by listing agency.
      b. Mark product packing with classification marking of listing agency.
      c. Unlisted Systems: Where firestop systems not listed by any listing agency are required due to project conditions, submit a substitution proposal with evidence specified.
      d. Firestopping Exposed To View: Provide products with flame spread index of less than 25 and smoke developed index of less than 450, when tested in accordance with ASTM E 84.
      e. Firestopping Exposed to View, Traffic, Moisture, or Physical Damage: Provide products that after curing do not deteriorate when exposed to those conditions during and after construction.
      f. Materials: Use only products specifically listed for use in listed systems.
      g. Compatibility: Provide products that are compatible with each other, with the substrates forming openings, and with the items, if any, penetrating the firestopping, under the conditions represented by this project, based on testing and field performance demonstrated by manufacturer.

B. Accessories: Provide all accessory materials required for complete installation; use materials specifically identified in system listings.

C. Identification Labels for Through Penetration Systems: Pressure sensitive self-adhesive vinyl labels, preprinted with the following information:

D. The words "Warning - Through Penetration Firestop System - Do not Disturb. Notify Building Management of Any Damage."
   1. Listing agency's system number or designation.
   2. System manufacturer's name, address, and phone number.
   3. Installer's name, address, and phone number.
   4. General contractor's name, address, and phone number (if applicable).
   5. Date of installation.

3.0 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Conduct tests according to manufacturer's written recommendations to verify that substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt and other foreign substances capable of impairing bond of firestopping.

C. Verify that items penetrating fire rated assemblies are securely attached, including sleeves, supports, hangers, and clips.

D. Verify that openings and adjacent areas are not obstructed by construction that would interfere with installation of firestopping, including ducts, piping, equipment, and other suspended construction.

E. Verify that environmental conditions are safe and suitable for installation of firestopping.

F. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Prepare substrates in accordance with manufacturer's instructions and recommendations.

B. Install masking and temporary coverings as required to prevent contamination or defacement of adjacent surfaces due to firestopping installation.

3.3 INSTALLATION

A. Install in strict accordance with manufacturer's detailed installation instructions and procedures.

B. Install so that openings are completely filled and material is securely adhered.

C. Where firestopping surface will be exposed to view, finish to a smooth, uniform surface flush with adjacent surfaces.

D. After installation is complete, remove combustible forming materials and accessories that are not part of the listed system.

E. Repair or replace defective installations to comply with requirements.

F. At each through penetration, attach identification labels on both sides in location where label will be visible to anyone seeking to remove penetrating items or firestopping.

G. Clean firestop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by firestop system manufacturer and which will not damage the surfaces being cleaned.

H. Notify AHJ when firestopping installation is ready for inspection; obtain advance approval of anticipated inspection dates and phasing, if any, required to allow subsequent construction to proceed.

I. Do not cover firestopping with other construction until approval of AHJ has been received.

3.4 FIELD QUALITY CONTROL

A. Owner may engage an independent testing agency to inspect installed firestopping and to prepare reports indicating whether the installed work complies with the contract documents.

B. Notify testing agency at least 7 days prior to date when firestopping installation will be ready for inspection; obtain advance approval of general schedule and phasing, if any, required to allow subsequent construction to proceed.

3.5 PROTECTION

A. Protect installed systems and products until completion of project; where subject to traffic, provide adequate protection board.

B. Touch-up, repair or replace damaged systems and products before Substantial Completion.

END OF SECTION 07840

SECTION 15330 – AUTOMATIC FIRE SPRINKLER SYSTEM

1.0 GENERAL

1.1 Related Documents

A. Drawings, Hydraulic Calculations and general provisions of the Contract and Agreement apply to this Section.

B. Project Manual

1.2 Summary

A. Drawings supplied with this specification shall be used as a reference for the requirement and location of system components. Work includes visiting the site to observe the existing conditions, and confirmation of the required quantities of devices and specific options for locations of the same. The contractor shall not use the drawings only to infer quantities of sprinklers for price quotation.

B. At the time of bid, all exceptions taken to these Specifications, variances from these Specifications and all substitutions of equipment specified shall be listed in writing and forwarded to Hughes Associates, Inc. (Engineer) and City of Warwick (Owner). Any such exceptions, variances, or substitutions, which were not listed at the time of bid shall not be approved or considered.

C. The Work includes all labor, materials, tools, transportation, and temporary construction necessary to design, fabricate, install, test and flush a fully operational and code compliant automatic wet-pipe fire sprinkler system. The sprinkler contractor shall be responsible for all new above ground piping. The sprinkler contractor shall be responsible for all underground work included in the scope of work identified herein and on provided drawings.

D. The Work includes furnishing and installing sprinklers including piping, hangers and other associated components in areas of the building discovered during survey or installation that are not necessarily represented on the design drawings that are required to be provided with sprinkler protection at no additional cost to the owner. The scope of work includes the installation of sprinkler guards on all sprinklers subject to mechanical damage including but not limited to sprinklers installed below the Astro-Rink Insulation layer, in mechanical and storage rooms, and in spaces where sprinklers are installed below 7 feet.

E. The Work includes connection of new waterflow, and valve supervisory switches to the fire alarm system in the building. The Contractor shall be responsible to coordinate these wiring connections with the fire alarm contractor.

F. The Work includes all cutting, drilling, core drilling, etc. to install the fire sprinkler system through the existing walls.

G. The Work includes fire stopping, patching and painting of all penetrations that were made for installation of new sprinkler piping through existing interior and exterior building walls.

The fire stopping shall be conducted by a manufacturer's trained personnel acceptable to the Owner.

H. The Work includes all fees and activities required to secure approvals for necessary State and Local permits.

I. The Work includes submitting detailed Working Plans, Hydraulic Calculations and Product Data to the Engineer for review prior to submitting same to local officials for permit. Contractor shall not fabricate piping, assemble components or begin installation until Hughes has approved the submittal documents.

J. The Work includes performing field quality control and commissioning activities.

K. The Work includes documenting and submitting the results of integrity and functional testing.

L. The Work includes submitting As-built Plans and closeout documentation to Hughes for review prior to scheduling Owner demonstration training.

M. The Work includes training Owner's personnel on the operation of the system, required maintenance tasks and frequencies, and the locations of all spare tools and equipment, valves, flow switches, risers and equipment necessary to maintain and operate the sprinkler system.

N. **Deduct Alternate 1 -** Remove all pendent sprinklers below the Astro-Rink layer and associated fittings and piping, as shown on FP-A1.1 through FP-A1.3. Upright sprinklers above Astro-Rink layer to remain as shown. Installation of upright sprinklers and trim piping shall be in accordance with typical upright sprinkler detail.

1.3 Performance Requirements

A. A wet-pipe, hydraulically calculated automatic fire sprinkler system shall be installed in all areas of the building.

B. Water Flow Test Data

1. A water flow test has been conducted by Hughes. The Sprinkler Contractor shall conduct a new test with no additional cost to the Owner prior to developing shop drawings if the data is more than one year old.

C. Pipe sizes for piping shall be determined by hydraulic calculations in accordance with NFPA 13-2010. Verify that field modifications to the system, which require the addition of fittings and pipe do not adversely affect the hydraulic demand of the automatic fire sprinkler system.

1. If, given the available water supply as indicated on the drawings, the automatic fire sprinkler system cannot be designed in compliance with this specification and the applicable codes and standards, provide a report to the Owner documenting the design options that have been investigated. Additionally, copies of the hydraulic calculations, which demonstrate the inability of the water distribution system to supply the necessary water for the sprinkler system demand, shall be submitted for each option.

D. Sprinkler system shall be designed according to the following:

1. A minimum 10% margin of safety shall be provided between the residual water supply pressure and the required sprinkler system demand pressure at the calculated system design flow, including all hose allowances.

2. Sprinkler Occupancy Hazard Classifications shall be as follows:
   a. Light Hazard
      1) Ice Rinks
      2) Offices
      3) Locker Rooms
   b. Ordinary Hazard, Group 1
      1) Storage areas.
      2) Mechanical equipment rooms.

3. Minimum Density for Automatic-Sprinkler System Piping Design:
   a. Light-Hazard Occupancy: 0.10-gpm over 1500- sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15-gpm over 1500- sq. ft. area.
   c. Design areas shall be modified as necessary to comply with the requirements for specific building or system features identified in NFPA 13-2010, such as non-sprinklered concealed combustible spaces that do not conform to the exceptions outlined in NFPA 13 under special conditions, or sloped ceilings/roofs.

4. Maximum Protection Area per Sprinkler:
   a. Light Hazard Areas: 225-sq. ft. (20.9-sq. m) unless otherwise indicated on drawings.
   b. Ordinary Hazard Areas: 130-sq. ft. (9.3-sq. m).
   c. All obstruction rules shall be strictly adhered to. Additional sprinklers shall be added, where required for compliance with NFPA 13-2010, at no additional cost to the owner.

5. Calculate pressure loss due to elevation and friction loss through all fittings, pipes, valves and backflow prevention devices in accordance with NFPA 13-2010.

6. Hose Allowance:
   a. Light Hazard Areas: 100-gpm outside hose allowance.
   b. Ordinary Hazard Areas: 250-gpm outside hose allowance.

E. Components shall be capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating, unless otherwise indicated.

1.4 Order of Precedence

A. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply; however, should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:

1. State and local codes shall take precedence over this specification.

2. The National Fire Protection Association Standards shall take precedence over this specification.

3. This specification shall take precedence over the drawings.

1.5 Submittals

A. In the event that the any of the following submittal packages is required to be revised and re-submitted due to nonconformance with this specification, illegibility of the submittal, incomplete submittals, noncompliance with the referenced local, state and national Codes, Standards and Regulations or nonconformance with pertinent documentation relative to the project, the Contractor, in advance, shall pay a $1,500.00 fee associated with the additional submittal review. Payment of the fee shall be solely the Contractor's responsibility.

B. Pre-Installation Documentation: Absolutely no work or material fabrication shall be conducted prior to submittal and approval by the Engineer.

1. Product Data: For each product specified in Part 2. Submittal shall indicate listing and approvals, selected options, finishes, etc. and electrical characteristics.

2. Working Plans: Minimum 1/8"=1'-0" scale inclusive of information required by NFPA 13-2010 requirements.

3. Electronic Working Plans: Minimum 1/8"=1'-0" scale inclusive of information required by NFPA 13-2010 requirements. The electronic versions of the hard-copy plans shall be submitted on compact disks in PDF format

4. Hydraulic Calculations: Prepared in accordance with NFPA 13-2010 requirements. Minimum one (1) calculation for each hazard on each level.

C. Acceptance Documentation:

1. Field Test Reports and Certificates (Aboveground): Completed FMG Form 85A "Contractor's Material and Test Certificate for Aboveground Piping" including dates of successful hydrostatic tests, functional water flow tests, and other fire alarm supervisory tests. Tests and documents shall be witnessed and countersigned by the Owner's designee. Annotate portions of the Certificate form that do not apply to the project as "not applicable". Make submittal after commissioning and prior to acceptance testing.

2. Testing documentation of the backflow prevention device.

3. Statement of Completion: Upon completion of the installation of the automatic sprinkler system, a signed written statement, substantially in the form as follows:

"The undersigned, having been engaged as the Sprinkler Contractor for the automatic sprinkler system at 975 Sandy Lane for the Warwick Municipal Buildings Fire Alarm and Sprinkler Upgrade Project located in Warwick, Rhode Island, confirms that the automatic fire sprinkler system equipment was installed in accordance with the diagrams, instruc-

tions, directions, and technical specifications provided to us by the Manufacturer and the City of Warwick."

D. Closeout Documentation:

1. Maintenance Data: The maintenance manual shall describe in detail the purpose and function of all sprinkler system devices and valves. The manual shall also include all necessary inspection, testing and maintenance forms. Include one (1) original, soft-bound copy of NFPA 25-2011, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*, in addition to the maintenance manual.

2. As-Built Drawings: Showing all field changes from original Working Plans. Submit full-size hard copy and electronic AutoCAD files on compact disk. Coordinate AutoCAD version with Owner at time of submittal.

3. Valve Chart: Provide a drawing on 11-inch x 17-inch paper identifying the location of the control valves for the fire sprinkler system shown on the floor plan of the building. This valve chart shall be framed and permanently installed adjacent to the fire alarm control unit.

4. Statement of Warranty.

1.6 Quality Assurance

A. Equipment and devices shall be labeled and listed for the intended use in the Underwriters Laboratories, Inc. (UL), UL FPED-2011 *Fire Protection Equipment Directory*, or the most recent FM Global Approval Guide.

B. Electrical components, devices, and accessories shall be Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

C. All materials and equipment shall be new and unused.

D. All equipment shall be first quality and capable of complying with all requirements of this specification and shall have been in continuous production and in service in commercial applications for at least one year. Obsolete equipment shall not be used.

E. Installer Qualifications:

1. Licensed in the State of Rhode Island and experienced in the installation of automatic fire sprinkler systems in buildings similar to the Work described herein and has obtained design and inspection approvals for similar projects from authorities having jurisdiction.

2. Foreman: Provide proof of competence of both their company and the individual foreman that will be assigned to this project, in the area of installing automatic fire sprinkler systems for at least five (5) years and acceptable to Owner. Once assigned, the foreman shall not be changed without the approval of the Owner.

3. Service Organization: Capable of providing a service technician on-site within 4 hours of a request for on-site service.

F. The automatic fire sprinkler systems shall comply with all applicable state and local codes, including the Rhode Island Fire Safety Code (RIFSC).

G. Products, installation and testing shall be in accordance with the applicable provisions of the following as referenced by the RIFSC:

1. National Fire Protection Association (NFPA) 13-2010, *Standard for the Installation of Sprinkler Systems.*

2. NFPA 25-2011, *Standard for Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.*

3. NFPA 70-2011, *National Electrical Code.*

4. NFPA 72-2010, *National Fire Alarm Code*.

1.7 Coordination

A. Coordinate sprinkler location and installation with existing conditions and other portions of the Work to ensure sprinkler locations are at the highest possible elevations and generally located to minimize the risk of mechanical damage.

B. Coordinate sprinkler installation with existing conditions and other portions of the Work to comply with NFPA 13-2010 requirements for obstruction to sprinkler discharge.

C. Coordinate pipe installation with existing conditions and other portions of the Work to facilitate suspended ceiling installation, proper pitch and accessibility for components installed.

D. Coordinate with the Fire Alarm portion of the Work for the connection and testing of water flow, pressure and valve supervisory switches.

1.8 Extra Materials

A. Furnish extra materials described below that match the products installed and that are packaged with protective covering for storage and identified with labels describing the contents.

1. Sprinkler Cabinet: Finished, wall-mounting steel cabinet and hinged cover, with space for a minimum of six (6) spare sprinklers for each type, model and temperature rating, plus a sprinkler wrench for each model.

1.9 Warranty

A. Guarantee equipment installed to be free from defects in workmanship and inherent mechanical defects for a period of one (1) year from the date of substantial completion of the project. See Part 1 “Submittals”.

1.10 Scaffolding, Rigging and Hoisting

A. Provide scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of material, equipment and apparatus furnished under this division. Remove same from premises upon completion of work.

1. The Contractor shall install staging above each ice rink. Thermal insulation layer to remain in place for duration of construction. Staging to be removed after above-insulation work is complete.
   a. Where insulation must be removed for access above, the Contractor shall remove only sections necessary to complete the work in the back arena. Provide all services to remove and reinstall thermal insulation layer. Surface shall be returned to original state and to the satisfaction of the Owner.
   b. All sections damaged shall be replaced by the Contractor at no cost to the Owner.
   c. Coordinate with other trades for above Astro-Rink layer work.

1.11 Cutting and Patching

A. Provide all cutting and patching necessary to install the work specified in this division. Patching shall match adjacent surfaces. Surfaces to be returned to original condition and to the satisfaction of the Owner. Coordinate with other trades for above finished ceiling work.

1.12 Demolition

A. The Contractor shall remove all existing fire protection components including but not limited to:

1. Existing detector check valve in exterior pit.
2. Existing fire department connection.
3. Existing check valve serving the existing fire department connection.
4. Existing two (2) hose valve connections
5. Existing fire protection piping including pipe connecting hose valves to water supply.

2.0 PRODUCTS

2.1 Manufacturers

A. Subject to compliance with the requirements of this section, product selection shall be limited to those offered by manufacturers included in the “Available Manufacturer” lists in each Part 2 article. Substitution of the products listed requires approval by the Owner in writing prior to installation.

B. Where lists are not indicated, products, subject to compliance with the requirements of this section, may be obtained from an approved domestic manufacturer.

2.2 Pipe and Tube

A. Standard-Weight Steel Pipe: Schedule 40 ASTM A53, ASTM A135, or ASTM A795, carbon steel, threaded ends.

B. Standard-Weight Steel Pipe: Schedule 40 ASTM A53, ASTM A135, or ASTM A795, carbon steel, grooved ends.

2.3 Pipe and Tube Fittings

A. Cast-Iron Threaded Fittings: ASME B16.4; Class 125 or Class 250 pattern as required by application.

B. Malleable-Iron Threaded Fittings: ASME B16.3; ASME B16.4; Class 125 or Class 250 pattern as required by application.

C. Steel Threaded Couplings: ASTM A865; ASME B16.4; Class 125 or Class 250 pattern as required by application.

D. Steel Welding Fittings: ASTM A234/A 234M, ASME B16.9, or ASME B16.11; 300-psi pressure rating.

E. Cast-Iron Threaded Flanges: ASME B16.1; ASME B16.4; Class 125 plain face or Class 250 raised face pattern as required by application.

F. Steel Flanges and Flanged Fittings: ASME B16.5; ASME B16.4; Class 125 plain-face or Class 250 raised face pattern as required by application.

G. Flange Gaskets and Bolts

1. Plain-face Flanges: ASME B18.2.2 heavy-series hex-nuts and ASME B18.22.1 plain washers with ASME B16.21 1/8” full-face rubber gasket.

2. Raised-face Flanges: ASME B18.2.2 heavy-series hex-nuts and ASME B18.22.1 plain washers with ASME B16.20 1/8” spiral wound gasket.

H. Mechanical Grooved-End Fittings:

1. Assembly Pressure Rating: 300-psi

2. Fittings and Couplings: UL 213; ASTM A536 ductile iron body.

3. Couplings: UL 213; ASTM A536 ductile iron rigid or flexible pattern as required by application.

4. Gaskets and Bolts: Pre-lubricated EPDM gaskets with ASTM A183 zinc-plated nuts and bolts.

5. Available Manufacturers

   a. Tyco Fire and Building Products.

   b. Victaulic Corporation of America.

2.4 Valves

A. General: Minimum 175-psig (1200-kPa) non-shock working-pressure rating unless higher pressure rating is required by application or otherwise indicated. Valves for grooved-end pipe may be furnished with grooved ends instead of flanged ends.

B. Gate Valves; NPS 2 (DN50) and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and pre-grooved rising stem. NPS 2-1/2 (DN65) and Larger: UL 262, iron body, bronze mounted, tapered wedge, OS&Y, and pre-grooved rising stem. Include replace-able, bronze, wedge facing rings and flanged ends.

1. Available Manufacturers

    a. McWane, Inc; Kennedy Valve Div.

    b. Mueller Co.

    c. NIBCO Inc.

C. Swing Check Valves; NPS 2 (DN50) and Smaller: UL 312; cast-bronze, threaded ends. NPS 2-1/2 (DN65) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.

1. Available Manufacturers

    a. Grinnell Corp.

    b. McWane, Inc; Kennedy Valve Div.

    c. Mueller Co.

    d. NIBCO Inc.

    e. Victaulic Co.

    f. Viking Corp.

D. Indicating Valves; NPS 2 (DN65) and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device and pre-wired supervisory switch. NPS 2-1/2 (DN65) and Larger: UL 1091; butterfly-type, ductile-iron body with grooved ends; and integral indicating device and pre-wired supervisory switch.

1. Available Manufacturers

    a. Tyco Co.

    b. Milwaukee Valve Co.

    c. Reliable Sprinkler Co.

    d. Victaulic Co.

    e. Viking Corp.

E. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends.

2.5 Backflow Prevention Devices

A. Double Check Valve Assembly (DCVA) type with epoxy-coated cast iron or stainless steel body, test cocks and grooved end UL 1091 indicating butterfly valves or, if required by the local Water Authority, UL 262 gate valves.

1. DCVA shall be approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California (USC).

B. Available Manufacturer and Model.

1. Ames Co. –Maxim Series Model M200 with UL listed and FM Approved grooved gear operated butterfly valves with tamper switches, or Engineer approved equivalent.
2. Watts Series 709 with UL listed and FM Approved OS&Y control valves and tamper switches or Engineer approved equivalent.

2.6 Sprinklers

A. General: UL 199 nominal 1/2-inch (12.7-mm) orifice standard-spray pattern sprinklers with “Ordinary” temperature classification rating, unless otherwise indicated or required by application.

B. Pressure Rating: 175-psi (1200kPa) minimum unless otherwise indicated or required by application.

C. Operating Element: Quick Response (QR) as indicated or required by application, eutectic metal type thermal operating mechanism or frangible glass bulb.

D. Sprinkler Types and Features; include the following:

1. Upright.

2. Horizontal Sidewall.

3. Pendent/Recessed Pendent.

4. Extended Coverage Ordinary Hazard Horizontal Sidewall.

E. Sprinkler Finishes; include the following:

1. Rough-brass (bronze)

F. Sprinkler Guards: Wire-cage type with red finish, including fastening device for attaching to sprinkler.

G. Available Manufacturers

1. Tyco Fire and Building Products..

2. Reliable Sprinkler Co.

3. Victaulic Co.

4. Viking Corp.

2.7 Fire Alarm Monitoring Devices

A. General: NEMA enclosure suitable for intended application; include tamper resistant cover with switch that transmits signal upon removal of cover; 250-psi (1752-kPa) pressure rating; two sets, single-pole double-throw form ‘C contacts.

B. Pressure Switches: UL 753 field adjustable and configured to allow for function as either a water flow indicator upon pressure increase or as a low-pressure indicator upon pressure decrease.

C. Valve Supervisory Switches: UL 753 with normally closed contacts and compatible with valve stem to be monitored.

D. Available Manufacturers

1. Pittway Corp.; System Sensor Div.

2. Potter Electric Signal Co.

2.8 Pipe Sleeves

A. Provide sleeves for all work passing through floor, wall, and ceiling construction. Locate and provide sleeves and inserts before the floor, wall or ceiling is constructed. If this contractor does not comply with the above, he shall bear all costs incurred for cutting and patching required for the installation of sleeves and inserts. Holes required for sleeves in existing walls and floors, or to conform to the above shall be saw cut or core drilled. This Contractor shall provide all drilling required for the installation of hangers.

B. Pipe sleeves through outside walls shall be Schedule 80 black steel pipe with 150 lb. black steel slip-on welded flanges welded at the center of the outside. Extend sleeves 1/2 inch beyond each side of the wall. Pack the space between sleeve and pipe with oakum to within 2 inches of each face of the wall. Pack the remaining space and make watertight with an approved waterproof compound.

C. Pipe sleeves through concrete floors or interior masonry walls shall be Schedule 40 black steel pipe, set flush with finished wall or ceiling surfaces, but extending 2 inches above finished floors. Plastic, PVC, or light metal sleeves shall not be installed.

D. Provide individual or strip type inserts pressed steel construction with accommodation for removable nuts and threaded rods up to 3/4-inch diameter, permitting lateral adjustment. Individual inserts shall have an opening at the top to allow reinforcing rods to 1/2 inch diameter to be passed through the insert body. Strip inserts shall have attached rods with hooded ends to allow fastening to reinforcing rods.

E. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where sleeves pass insulated pipes, the sleeves shall be large enough to pass the pipe and the insulation. Check floor and wall construction finishes to determine proper length of sleeves for various locations.

F. Provide 22 gauge galvanized steel duct sleeves through interior walls, floors and ceilings set flush with finished surfaces.

G. Pack the space between sleeves and structure, and sleeves and pipes or ducts passing through fire rated interior walls, floors, and ceilings with an approved fire and smoke proof packing material. Fire-stopping material shall maintain its dimensions and integrity while preventing the passage of flame, smoke, and gases under conditions of installation and user when exposed to the ASTM E119 time-temperature curve for a time period equivalent to the rating of the assembly penetrated. Cotton waste shall not ignite when placed in contact with the non-fire side during the test. Fire-stopping material shall be non-combustible as defined by ASTM E136; and in addition, for insulation materials, melt point shall be a minimum of 1700 degrees F. for 1-hour protection and 1850 degrees F. for 2-hour protection.

H. Fasten sleeves securely in floors, walls, etc. so that they will not become displaced when concrete is poured or when construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into the space between pipe and sleeve during construction.

I. In all areas where ducts are exposed and pass through floors, the hole shall be surrounded by a 4-inch high by 3-inch wide concrete curb, or otherwise protected as determined by the Engineer.

J. Escutcheon plates shall be provided for all exposed un-insulated pipes passing through walls, floors, and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe. Where plates are provided for pipes passing through sleeves, which extend above the floor surface, provide deep recessed plates to conceal pipe sleeves.

2.9 Pressure Gages

A. Water Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa).

2.10 Supports & Attachments

A. Provide all necessary supports and bases required for all equipment, piping and for all other equipment furnished under this contract. Submit shop drawings to the Engineer for approval before purchase, fabrication or construction of same.

B. All equipment, unless shown otherwise, shall be securely attached to the building structure in an approved manner, in accordance with NFPA 13. Attachments shall be of a strong and durable nature and any attachments that are not strong enough shall be replaced as directed.

2.11 Firestopping

A. Provide Firestopping systems for penetrations in fire-resistance-rated assemblies, including both membrane and through penetrations. This contractor shall thoroughly review architectural plans for assembly type and location and shall prepare bid accordingly.

B. Firestopping shall be in accordance with Section 07840.

C. Materials and systems shall be designed to meet the requirements of the intended application and shall be installed per manufacturer's guidelines.

D. Submittals: Provide for review Manufacturer's product literature and tested assembly for each type of fire protection material including product characteristics, typical uses, installation procedures, performance and limitation criteria.

3.0 EXECUTION

3.1 Examination

A. Coordinate examinations with the Owner.

B. Examine and verify actual locations of risers, mains and branch line piping prior to preparing pre-installation submittal.

C. Examine and verify points of connection to existing system components.

D. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing and other conditions where pipes, risers and cross-mains are to be installed prior to preparing pre-installation submittal.

E. Promptly report conflicts with proposed solutions.

3.2 Preparation

A. Prepare and submit a minimum of six (6) complete three ring bound "Pre-Installation Documentation" submittal packages to the Engineer for review prior to submitting same to local officials for approval and permit. Resubmit portions or entirety of submittal to address Engineer comments prior to submitting package to local officials for approval and permit. See Part 1 "Submittals" for submittal content.

B. Obtain authority approval and permits with reviewed "Pre-Installation Documentation" submittal package.

3.3 Piping Applications

A. Use the following:

1. NPS 6 (DN150) to NPS 2.5 (DN65): Schedule 40 steel pipe with roll grooved ends; steel, grooved-end fittings with rubber gaskets FM approved for deluge systems use where applicable; and grooved joint couplings.

2. NPS 2 (DN50) and Smaller: Standard-weight Schedule 40 steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.

B. Branch Line Connections to Cross Mains shall be cast- or malleable-iron threaded fittings, and threaded joints.

3.4 Piping Installation

A. Refer to manufacturer's specifications and NFPA 13-2010 for basic piping installation.

B. Install exposed piping as tight to ceiling as possible. Rise with elbows in series as necessary to adjust final height of piping. Cut hanger rods to length that allows nuts to be tightened flush with ceiling and leaves band hangers at the highest elevation possible.

C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 (DN50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN65) and larger connections.

F. Install sprinkler piping with drains for complete system drainage. All drain piping shall be routed to a location approved by the Owner.

G. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13-2010. The outlet shall discharge to the exterior of the building.

H. Install alarm devices in piping systems.

I. Hangers and Supports: Install according to NFPA 13-2010 for sprinkler piping.

J. Seismic Restraint: N/A.

K. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise required by NFPA 13-2010 for protection against Earthquake damage through masonry penetrations. Provide flexible couplings on piping penetrating rigid walls (i.e. masonry walls), within 1-foot on each side of the penetration.

L. Install pressure gages on riser or feed main, at each sprinkler test connection and on both sides of every check valve. Include pressure gages with connection not less than NPS 1/4 (DN8) and with soft metal seated 3-way valve, plugged at one end and arranged for draining

pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

M. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than the systems pressure rating may be used in aboveground applications, unless otherwise indicated.

3.5 Joint Construction

A. Refer to manufacturer's specifications for basic piping joint construction.

B. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with threaded ends or Schedule 40 steel pipe with roll-grooved ends; steel, grooved-end fittings; and groove couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to manufacturer's written instructions.

C. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal.

D. Refer to Manufacturer's specifications for grooved pipe fittings, pipe-flange gasket materials and welding filler metals.

E. Joint compound or tape shall be applied to male pipe threads only for all threaded joints.

F. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

3.6 Valve Applications

A. Drawings indicate valve types to be used.

3.7 Valve Installation

A. Install valves in accessible locations with indicators clearly visible from floor level.

3.8 Sprinkler Applications

A. Drawings indicate sprinkler types to be used.

B. Use QR sprinklers in Light Hazard and Ordinary Hazard areas.

3.9 Sprinkler Installation

A. Install sprinklers in accordance with NFPA 13-2010 and in the patterns indicated on the working drawings.

B. Install upright sprinklers where ceiling is exposed to structure at the highest elevation possible while observing the NFPA 13-2010 requirements for obstructions to sprinkler discharge. Do not lower the elevation of sprinklers to locate deflector below solid-continuous obstructions in lieu of providing adequate horizontal clearance in accordance with NFPA 13-2010 §8.6.5.1.

C. Install sprinklers in the center of suspended ceiling tiles where such ceilings exist or are planned.

D. Use sprinkler guards listed for use with sprinkler where indicated on drawings and where sprinkler is subject to mechanical damage. At a minimum, provide caged upright or pendent sprinklers in closets, beneath stair landings, storage areas, locker rooms, areas open to the ice rink and mechanical areas. Use sprinkler guards where sprinklers are installed at an elevation of 7 ft. or less above the finished floor.

E. Do not install sprinklers, mains or branch line pipes in locations where likely to be inadvertently damaged, such as in front of access hatches, doors, cabinets, etc.

F. Install only sprinkler piping dedicated for required protection of electrical equipment rooms within such rooms. Do not run piping over electric panels.

3.10 Fire Alarm Monitoring Device Installation

A. Install water flow, pressure and valve supervisory switches to be connected by the Fire Alarm portion of the Work.

B. Adjust retard feature of “main” water flow indicating switches to 35 seconds.

C. Adjust retard feature of “zone” water flow indicating switches to 45 seconds.

3.11 Labeling And Identification

A. Install labeling, signs and pipe markers on valves, equipment and piping in accordance with NFPA 13-2010.

B. Signs and label styles and locations shall be coordinated with and approved by the Owner and the authorities having jurisdiction prior to installation.

C. Install hydraulic design information sign on the “main system riser”.

3.12 Field Quality Control

A. Perform hydrostatic test of entire sprinkler system and inspect sprinkler piping according to NFPA 13-2010, "System Acceptance". Coordinate hydrostatic test date(s) and time(s) with the Owner’s designee.

1. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

2. Use the NFPA 13-2010 "Contractor's Material and Test Certificate for Aboveground Piping" to document the hydrostatic test results. Prepare a separate form for each sprinkler zone. Obtain dated signature from Owner's designee for each test. Tests that are not witnessed must be repeated.

3.13 Commissioning

A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.

B. Verify that specified tests of piping are complete.

C. Verify that damaged sprinklers and sprinklers with paint or coating not specified, are replaced with new, correct type.

D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.

E. Verify that potable-water supplies have correct types of backflow prevention devices and have been tested.

F. Verify that spare sprinkler cabinet is installed with correct number of wrenches and spare sprinklers.

G. Verify that labeling, identification and signage is installed.

H. Energize circuits to electrical equipment and devices.

I. Coordinate with fire alarm pre-acceptance tests. Operate as required.

1. Use the NFPA 13-2010 "Contractor's Material and Test Certificate for Aboveground Piping" to document the water flow switch activation times and other functional test results. Obtain dated signature from Owner's designee for each test. Tests that are not witnessed must be repeated. Use common form for each zone that indicates results of previous hydrostatic testing and fire alarm functional tests.

3.14 Cleaning and Protection

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers having paint other than factory applied finish.

C. Wipe all excess pipe joint compound from threaded pipe joints.

D. Wipe all excess oil from the exterior surface of sprinkler mains and branch line pipes.

E. Protect sprinklers from damage until substantial completion by other trades.

3.15 Authority Having Jurisdiction Final System Acceptance

A. Prepare and submit a minimum of six (6) complete three ring bound "Approval Documentation" submittal packages to the Owner's representative for review prior to submitting same to local officials for final system approval. Resubmit portions or entirety of submittal to address Owner's representative comments prior to submitting package to local officials. See Part 1 "Submittals" for submittal content.

B. Submit reviewed "Approval Documentation" submittal package to authority and coordinate scheduling of common fire sprinkler and fire alarm system acceptance testing.

C. Coordinate with fire alarm portion of final acceptance tests. Operate as required. Demonstrate system components to authority having jurisdiction as necessary.

3.16 Project Closeout Procedures

A. Prepare and submit a minimum of six (6) three-ring bound closeout documentation packages to the Owner's representative for review prior to scheduling Owner demonstration and training. Resubmit portions or entirety of submittal to address Owner's representative comments prior to scheduling demonstration and training. See Part 1 "Submittals" for submittal content.

B. Schedule Owner demonstration and training with the Owner. Provide at least five (5) working days notice.

C. Demonstrate equipment, specialties, and accessories with the Owner. Review operating and maintenance information with the Owner.

END OF SECTION 15330

Attachment 1: Hydraulic Calculation 1 – South Ice Rink

HUGHES ASSOCIATES, INC.
117 METRO CENTER BOULEVARD, SUITE 1002
WARWICK, RI 02886

HYDRAULIC CALCULATIONS FOR
WARWICK MUNICIPAL BUILDINGS
975 SANDY LANE
WARWICK, RI 02889

DRAWING NUMBER: FP-1.3 DATE: SEP 3, 2014

-DESIGN DATA-

REMOTE AREA NUMBER: 3 REMOTE AREA LOCATION: REFRIG. ROOM

OCCUPANCY CLASSIFICATION: ORDINARY HAZARD 1 (OH-1)
DENSITY: .15 gpm/sq. ft.
AREA OF APPLICATION: 1555 sq. ft.

COVERAGE PER SPRINKLER: 117 sq. ft.
TYPE OF SPRINKLERS CALCULATED: QUICK RESPONSE K=5.6
NUMBER OF SPRINKLERS CALCULATED: 14

SPRINKLER DEMAND: 290.8 gpm
HOSE-STREAM DEMAND: 250.0 gpm
TOTAL WATER REQUIRED (INCLUDING HOSE): 540.8 gpm
FLOW AND PRESSURE (AT BASE OF RISER): 290.8 gpm @ **50.4** psi

TYPE OF SYSTEM: WET PIPE
DETAILS:

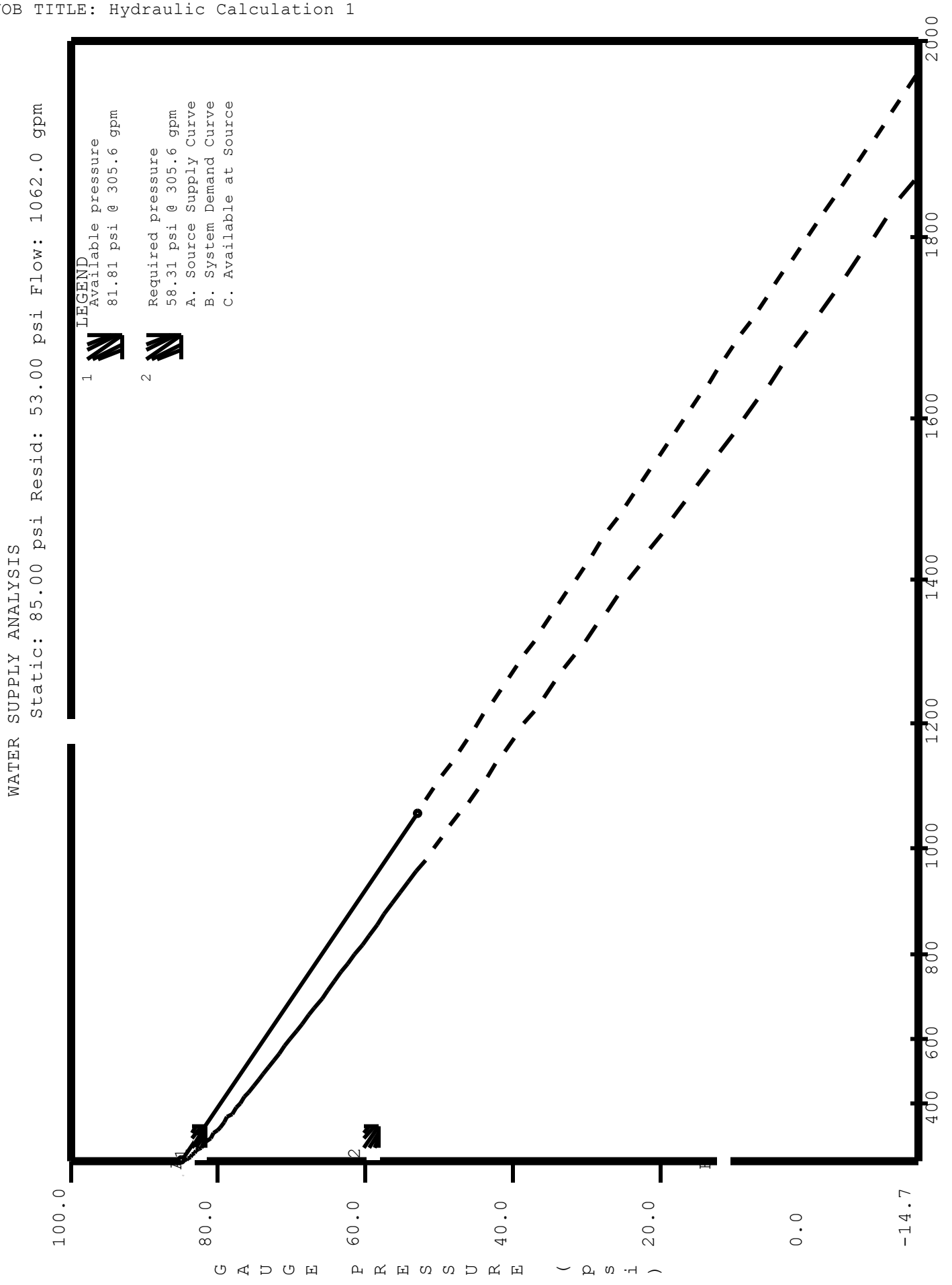
WATER SUPPLY
Source: Municipal Water (8-inch underground)
Test Date: 06-19-2014 Test By: WARWICK WATER DEPT.
Flow Hydrant 6-265 - WHITFORD ST., N. OF INGALLS ST.
Static: 85 psi Residual: 53 psi Flow: 1062 gpm
Source Elevation Relative to Finished Flow Level: 0 ft.

NAME OF DESIGNER: Hughes Associates, Inc.
AUTHORITY HAVING JURISDICTION: WARWICK FIRE DEPARTMENT

Calculations performed by HASS under license # 3801093320 ,
granted by HRS SYSTEMS, INC.

(Notes continue after pipe calculations results.)
(Notes continue after pipe calculations results.)

DATE: 9/3/2014 C:\HASSDATA\ICE RINK 5.SDF
JOB TITLE: Hydraulic Calculation 1



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NFPA WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. @ (PSI)	FLOW (GPM)	AVAIL. PRESS. @ (PSI)	TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SOURCE	85.0	53.0	1062.0	81.8	305.6	58.3

Required pressure is 23.5 psi (29%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	305.6 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	100.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	205.6 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
S201	24.8	- - - -	18.3	- - -	
S202	24.8	- - - -	16.4	- - -	
S203	24.8	K= 5.60	12.6	19.9	
S204	24.8	K= 5.60	12.1	19.5	
S205	24.8	K= 5.60	12.1	19.5	
S206	24.8	K= 5.60	12.5	19.8	
S207	24.8	- - - -	16.1	- - -	
S208	24.8	- - - -	17.8	- - -	
S209	24.8	- - - -	18.4	- - -	
S210	24.8	- - - -	16.5	- - -	
S211	24.8	K= 5.60	12.7	19.9	
S212	24.8	K= 5.60	12.2	19.6	
S213	24.8	K= 5.60	12.2	19.5	
S214	24.8	K= 5.60	12.6	19.9	
S215	24.8	- - - -	16.2	- - -	
S216	24.8	- - - -	17.9	- - -	
S217	24.8	- - - -	21.8	- - -	
S218	24.8	K= 5.60	18.3	24.0	
S219	24.8	K= 5.60	18.3	24.0	
S220	24.8	- - - -	21.7	- - -	
S221	24.8	- - - -	22.4	- - -	
S222	24.8	- - - -	23.1	- - -	
S223	24.8	- - - -	23.7	- - -	
M201	22.0	- - - -	28.2	- - -	
M202	22.0	- - - -	28.3	- - -	
M203	22.0	- - - -	28.5	- - -	
M204	22.0	- - - -	29.0	- - -	
M205	22.0	- - - -	29.6	- - -	
M206	22.0	- - - -	30.3	- - -	
M207	22.0	- - - -	31.0	- - -	
M208	22.0	- - - -	31.7	- - -	
M209	22.0	- - - -	32.3	- - -	

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JOB TITLE: Hydraulic Calculation 1

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
M210	22.0	- - - -	32.9	- - -	
M211	22.0	- - - -	33.5	- - -	
M212	22.0	- - - -	25.4	- - -	
M213	22.0	- - - -	25.6	- - -	
M214	22.0	- - - -	26.2	- - -	
M215	22.0	- - - -	27.6	- - -	
M216	22.0	- - - -	28.8	- - -	
M217	22.0	- - - -	29.8	- - -	
M218	22.0	- - - -	30.7	- - -	
M219	22.0	- - - -	31.6	- - -	
M220	22.0	- - - -	32.3	- - -	
M221	22.0	- - - -	33.0	- - -	
M222	22.0	- - - -	33.7	- - -	
B201	22.5	- - - -	19.2	- - -	
B202	22.5	- - - -	17.4	- - -	
B203	22.5	- - - -	15.5	- - -	
B204	22.5	- - - -	15.0	- - -	
B205	22.5	- - - -	15.0	- - -	
B206	22.5	- - - -	15.4	- - -	
B207	22.5	- - - -	17.1	- - -	
B208	22.5	- - - -	18.8	- - -	
B209	22.5	- - - -	19.4	- - -	
B210	22.5	- - - -	17.5	- - -	
B211	22.5	- - - -	15.6	- - -	
B212	22.5	- - - -	15.0	- - -	
B213	22.5	- - - -	15.0	- - -	
B214	22.5	- - - -	15.5	- - -	
B215	22.5	- - - -	17.2	- - -	
B216	22.5	- - - -	18.8	- - -	
B217	22.5	- - - -	22.8	- - -	
B218	22.5	- - - -	22.0	- - -	
B219	22.5	- - - -	22.0	- - -	
B220	22.5	- - - -	22.7	- - -	
B221	22.5	- - - -	23.4	- - -	
B222	22.5	- - - -	24.0	- - -	
B223	22.5	- - - -	24.7	- - -	
TOR	22.0	- - - -	41.2	- - -	
BOR	2.0	- - - -	51.2	- - -	
DCVA	2.0	- - - -	56.2	- - -	
UNDG1	-6.0	- - - -	60.7	- - -	
UNDG2	-6.0	- - - -	60.7	- - -	
UNDG3	-6.0	- - - -	60.8	- - -	
SOURCE	0.0	SOURCE	58.3	205.6	

NFPA PIPE DATA

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 1		Source	0.0			E:27.0	90.00	150	2.5	
SOURCE	0.0	58.3	205.5	UNDG2	8.000	2T106.0	139.00		2.6	
UNDG3	-6.0	60.8	205.6		7.980	G: 6.0	229.00	0.000	0.1	
Pipe: 1b		0.0	0.0			E:31.6	215.00	150	0.1	
UNDG3	-6.0	60.8	205.5	UNDG1	8.000	T:61.4	100.03		0.0	
UNDG2	-6.0	60.7	205.5		8.230	G: 7.0	315.03	0.000	0.1	
Pipe: 1c		0.0	0.0				100.00	150	0.0	
UNDG2	-6.0	60.7	205.5	DCVA	8.000	G: 7.0	7.02		0.0	
UNDG1	-6.0	60.7	205.5		8.230		107.02	0.000	0.0	
Pipe: 1d		0.0	0.0			2E:34.0	50.00	140	4.5	
UNDG1	-6.0	60.7	205.5	BOR	D4.000	T:34.0	71.00		-3.5	
DCVA	2.0	56.2	205.5		4.220	G: 3.0	121.00	0.008	1.0	
Pipe: 1e			0.0	Fixed Pressure Loss Device						
DCVA	2.0	56.2	205.5	TOR		5.0 psi, 205.5 gpm				
BOR	2.0	51.2	205.5							
Pipe: 2		0.0	118.7	M211		2ETCB	22.00	120	10.0	
BOR	2.0	51.2	86.8	M222	4.000		74.00		-8.7	
TOR	22.0	41.2	205.5		4.026		96.00	0.014	1.3	
Pipe: 3		0.0	84.1	M221			89.67	120	7.6	
TOR	22.0	41.2	2.7	M211	2.000	E: 5.0	15.00		0.0	
M222	22.0	33.7	86.8		2.067	T:10.0	104.67	0.072	7.6	
Pipe: 4		0.0	121.5	M210			124.92	120	7.8	
TOR	22.0	41.2	-2.7	M222	2.500	E: 6.0	18.00		0.0	
M211	22.0	33.5	118.7		2.469	T:12.0	142.92	0.054	7.8	
Pipe: 5		0.0	121.5	M210			212.83	120	0.2	
M222	22.0	33.7	-118.7	TOR	1.250	2E: 6.0	18.00		0.0	
M211	22.0	33.5	2.7		1.380	2T:12.0	230.83	0.001	0.2	
Pipe: 6		0.0	123.1	M209			10.33	120	0.6	
M211	22.0	33.5	-1.6	M221	2.500	----	0.00		0.0	
M210	22.0	32.9	121.5		2.469		10.33	0.057	0.6	
Pipe: 7		0.0	82.4	M220			10.33	120	0.7	
M222	22.0	33.7	1.6	M210	2.000	----	0.00		0.0	
M221	22.0	33.0	84.1		2.067		10.33	0.068	0.7	
Pipe: 8		0.0	123.1	M209			212.83	120	0.1	
M221	22.0	33.0	-121.5	M211	1.250	2E: 6.0	18.00		0.0	
M210	22.0	32.9	1.6		1.380	2T:12.0	230.83	0.000	0.1	

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JOB TITLE: Hydraulic Calculation 1

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 9		0.0	123.0	M208			10.25	120	0.6	
M210	22.0	32.9	0.1	M220	2.500	----	0.00		0.0	
M209	22.0	32.3	123.1		2.469		10.25	0.058	0.6	
Pipe: 10		0.0	82.5	M219			10.25	120	0.7	
M221	22.0	33.0	-0.1	M209	2.000	----	0.00		0.0	
M220	22.0	32.3	82.4		2.067		10.25	0.066	0.7	
Pipe: 11		0.0	82.5	M219			212.83	120	0.0	
M209	22.0	32.3	-82.4	M221	1.250	2E: 6.0	18.00		0.0	
M220	22.0	32.3	0.1		1.380	2T:12.0	230.83	0.000	0.0	
Pipe: 12		0.0	121.3	M207			10.25	120	0.6	
M209	22.0	32.3	1.7	M219	2.500	----	0.00		0.0	
M208	22.0	31.7	123.0		2.469		10.25	0.058	0.6	
Pipe: 13		0.0	84.2	M218			10.25	120	0.7	
M220	22.0	32.3	-1.7	M208	2.000	----	0.00		0.0	
M219	22.0	31.6	82.5		2.067		10.25	0.066	0.7	
Pipe: 14		0.0	84.2	M218			212.83	120	0.1	
M208	22.0	31.7	-82.5	M220	1.250	2E: 6.0	18.00		0.0	
M219	22.0	31.6	1.7		1.380	2T:12.0	230.83	0.000	0.1	
Pipe: 15		0.0	118.4	M206			13.00	120	0.7	
M208	22.0	31.7	3.0	M218	2.500	----	0.00		0.0	
M207	22.0	31.0	121.3		2.469		13.00	0.057	0.7	
Pipe: 16		0.0	87.2	M217			13.00	120	0.9	
M219	22.0	31.6	-3.0	M207	2.000	----	0.00		0.0	
M218	22.0	30.7	84.2		2.067		13.00	0.068	0.9	
Pipe: 17		0.0	87.2	M217			212.83	120	0.2	
M207	22.0	31.0	-84.2	M219	1.250	2E: 6.0	18.00		0.0	
M218	22.0	30.7	3.0		1.380	2T:12.0	230.83	0.001	0.2	
Pipe: 18		0.0	114.0	M205			13.00	120	0.7	
M207	22.0	31.0	4.4	M217	2.500	----	0.00		0.0	
M206	22.0	30.3	118.4		2.469		13.00	0.054	0.7	
Pipe: 19		0.0	91.6	M216			13.00	120	0.9	
M218	22.0	30.7	-4.4	M206	2.000	----	0.00		0.0	
M217	22.0	29.8	87.2		2.067		13.00	0.073	0.9	
Pipe: 20		0.0	91.6	M216			212.83	120	0.5	
M206	22.0	30.3	-87.2	M218	1.250	2E: 6.0	18.00		0.0	
M217	22.0	29.8	4.4		1.380	2T:12.0	230.83	0.002	0.5	
Pipe: 21		0.0	107.9	M204			13.00	120	0.7	
M206	22.0	30.3	6.0	M216	2.500	----	0.00		0.0	
M205	22.0	29.6	114.0		2.469		13.00	0.050	0.7	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) / (Pe) / (Pf)	Notes
Pipe: 22		0.0	97.6	M215			13.00	120	1.0	
M217	22.0	29.8	-6.0	M205	2.000	----	0.00		0.0	
M216	22.0	28.8	91.6		2.067		13.00	0.080	1.0	
Pipe: 23		0.0	97.6	M215			212.83	120	0.9	
M205	22.0	29.6	-91.6	M217	1.250	2E: 6.0	18.00		0.0	
M216	22.0	28.8	6.0		1.380	2T:12.0	230.83	0.004	0.9	
Pipe: 24		0.0	100.0	M203			13.00	120	0.6	
M205	22.0	29.6	8.0	M215	2.500	----	0.00		0.0	
M204	22.0	29.0	107.9		2.469		13.00	0.046	0.6	
Pipe: 25		0.0	105.6	M214			13.00	120	1.2	
M216	22.0	28.8	-8.0	M204	2.000	----	0.00		0.0	
M215	22.0	27.6	97.6		2.067		13.00	0.090	1.2	
Pipe: 26		0.0	105.6	M214			212.83	120	1.4	
M204	22.0	29.0	-97.6	M216	1.250	2E: 6.0	18.00		0.0	
M215	22.0	27.6	8.0		1.380	2T:12.0	230.83	0.006	1.4	
Pipe: 27		0.0	23.1	B223			13.00	120	0.5	
M204	22.0	29.0	76.9	M202	2.500	----	0.00		0.0	
M203	22.0	28.5	100.0		2.469		13.00	0.040	0.5	
Pipe: 28		0.0	24.8	B217			13.00	120	1.3	
M215	22.0	27.6	80.7	M213	2.000	----	0.00		0.0	
M214	22.0	26.2	105.6		2.067		13.00	0.104	1.3	
Pipe: 30		0.0	38.4	B216			9.79	120	0.2	
M203	22.0	28.5	38.4	M201	2.500	----	0.00		0.0	
M202	22.0	28.3	76.9		2.469		9.79	0.024	0.2	
Pipe: 31		0.0	40.5	B209			9.79	120	0.6	
M214	22.0	26.2	40.3	M212	2.000	----	0.00		0.0	
M213	22.0	25.6	80.7		2.067		9.79	0.063	0.6	
Pipe: 33		0.0	0.0				9.79	120	0.1	
M202	22.0	28.3	38.4	B208	2.500	----	0.00		0.0	
M201	22.0	28.2	38.4		2.469		9.79	0.007	0.1	
Pipe: 34		0.0	0.0				9.79	120	0.2	
M213	22.0	25.6	40.3	B201	2.000	----	0.00		0.0	
M212	22.0	25.4	40.3		2.067		9.79	0.017	0.2	
Pipe: 35		0.0	0.0				71.50	120	3.8	
M203	22.0	28.5	23.1	B222	1.250	E: 3.0	9.00		-0.2	
B223	22.5	24.7	23.1		1.380	T: 6.0	80.50	0.045	3.6	
Pipe: 36		0.0	0.0				71.50	120	9.4	
M202	22.0	28.3	38.4	B215	1.250	E: 3.0	9.00		-0.2	
B216	22.5	18.8	38.4		1.380	T: 6.0	80.50	0.115	9.2	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) / (Pe) / (Pf)	Notes
Pipe: 37		0.0	0.0				71.50	120	9.4	
M201	22.0	28.2	38.4	B207	1.250	E: 3.0	9.00		-0.2	
B208	22.5	18.8	38.4		1.380	T: 6.0	80.50	0.115	9.2	
Pipe: 38		0.0	0.0				39.00	120	6.2	
M212	22.0	25.4	40.3	B202	1.250	E: 3.0	9.00		-0.2	
B201	22.5	19.2	40.3		1.380	T: 6.0	48.00	0.125	6.0	
Pipe: 39		0.0	0.0				39.00	120	6.3	
M213	22.0	25.6	40.5	B210	1.250	E: 3.0	9.00		-0.2	
B209	22.5	19.4	40.5		1.380	T: 6.0	48.00	0.126	6.0	
Pipe: 40		0.0	0.0				54.00	120	3.4	
M214	22.0	26.2	24.8	B218	1.250	E: 3.0	9.00		-0.2	
B217	22.5	22.8	24.8		1.380	T: 6.0	63.00	0.051	3.2	
Pipe: 41		0.0	0.0				14.66	120	1.7	
B208	22.5	18.8	38.4	B206	1.250	----	0.00		0.0	
B207	22.5	17.1	38.4		1.380		14.66	0.115	1.7	
Pipe: 42		0.0	19.8	S206			14.66	120	1.7	
B207	22.5	17.1	18.6	B205	1.250	----	0.00		0.0	
B206	22.5	15.4	38.4		1.380		14.66	0.115	1.7	
Pipe: 43		0.0	19.5	S205			15.00	120	0.4	
B206	22.5	15.4	-0.9	B204	1.250	----	0.00		0.0	
B205	22.5	15.0	18.6		1.380		15.00	0.030	0.4	
Pipe: 44		0.0	19.5	S205			15.00	120	0.0	
B204	22.5	15.0	-18.6	B206	1.250	----	0.00		0.0	
B205	22.5	15.0	0.9		1.380		15.00	0.000	0.0	
Pipe: 45		0.0	19.5	S204			15.00	120	0.5	
B203	22.5	15.5	0.9	B205	1.250	----	0.00		0.0	
B204	22.5	15.0	20.4		1.380		15.00	0.035	0.5	
Pipe: 46		0.0	19.9	S203			15.00	120	1.9	
B202	22.5	17.4	20.4	B204	1.250	----	0.00		0.0	
B203	22.5	15.5	40.3		1.380		15.00	0.125	1.9	
Pipe: 47		0.0	0.0				15.00	120	1.9	
B201	22.5	19.2	40.3	B203	1.250	----	0.00		0.0	
B202	22.5	17.4	40.3		1.380		15.00	0.125	1.9	
Pipe: 48		0.0	0.0				14.66	120	1.7	
B216	22.5	18.8	38.4	B214	1.250	----	0.00		0.0	
B215	22.5	17.2	38.4		1.380		14.66	0.115	1.7	
Pipe: 49		0.0	19.9	S214			14.66	120	1.7	
B215	22.5	17.2	18.6	B213	1.250	----	0.00		0.0	
B214	22.5	15.5	38.4		1.380		14.66	0.115	1.7	

DATE: 9/3/2014 C:\HASSDATA\ICE RINK 5.SDF
JOB TITLE: Hydraulic Calculation 1

Pipe Tag / Frm Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node / Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 50		0.0	19.5	S213			15.00	120	0.4	
B214	22.5	15.5	-1.0	B212	1.250	----	0.00		0.0	
B213	22.5	15.0	18.6		1.380		15.00	0.030	0.4	
Pipe: 51		0.0	19.5	S213			15.00	120	0.0	
B212	22.5	15.0	-18.6	B214	1.250	----	0.00		0.0	
B213	22.5	15.0	1.0		1.380		15.00	0.000	0.0	
Pipe: 52		0.0	19.6	S212			15.00	120	0.5	
B211	22.5	15.6	1.0	B213	1.250	----	0.00		0.0	
B212	22.5	15.0	20.5		1.380		15.00	0.036	0.5	
Pipe: 53		0.0	19.9	S211			15.00	120	1.9	
B210	22.5	17.5	20.5	B212	1.250	----	0.00		0.0	
B211	22.5	15.6	40.5		1.380		15.00	0.126	1.9	
Pipe: 54		0.0	0.0				15.00	120	1.9	
B209	22.5	19.4	40.5	B211	1.250	----	0.00		0.0	
B210	22.5	17.5	40.5		1.380		15.00	0.126	1.9	
Pipe: 55		0.0	0.0				14.66	120	0.7	
B223	22.5	24.7	23.1	B221	1.250	----	0.00		0.0	
B222	22.5	24.0	23.1		1.380		14.66	0.045	0.7	
Pipe: 56		0.0	0.0				14.66	120	0.7	
B222	22.5	24.0	23.1	B220	1.250	----	0.00		0.0	
B221	22.5	23.4	23.1		1.380		14.66	0.045	0.7	
Pipe: 57		0.0	0.0				15.00	120	0.7	
B221	22.5	23.4	23.1	B219	1.250	----	0.00		0.0	
B220	22.5	22.7	23.1		1.380		15.00	0.045	0.7	
Pipe: 58		0.0	24.0	S219			15.00	120	0.7	
B220	22.5	22.7	-0.9	B218	1.250	----	0.00		0.0	
B219	22.5	22.0	23.1		1.380		15.00	0.045	0.7	
Pipe: 59		0.0	24.0	S219			15.00	120	0.0	
B218	22.5	22.0	-23.1	B220	1.250	----	0.00		0.0	
B219	22.5	22.0	0.9		1.380		15.00	0.000	0.0	
Pipe: 60		0.0	24.0	S218			15.00	120	0.8	
B217	22.5	22.8	0.9	B219	1.250	----	0.00		0.0	
B218	22.5	22.0	24.8		1.380		15.00	0.051	0.8	
Pipe: 61		0.0	0.0				3.00	120	1.0	
S201	24.8	18.3	0.0		1.000	E: 2.0	12.00		1.0	
B201	22.5	19.2	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 62		0.0	0.0				3.00	120	1.0	
S202	24.8	16.4	0.0		1.000	E: 2.0	12.00		1.0	
B202	22.5	17.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	

DATE: 9/3/2014 C:\HASSDATA\ICE RINK 5.SDF
JOB TITLE: Hydraulic Calculation 1

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) / (Pe) / (Pf)	Notes
Pipe: 63		5.60	19.9	Disch			3.00	120	2.9	
B203	22.5	15.5	0.0		1.000	E: 2.0	12.00		-1.0	
S203	24.8	12.6	19.9		1.049	2T:10.0	15.00	0.129	1.9	
Pipe: 64		5.60	19.5	Disch			3.00	120	2.8	
B204	22.5	15.0	0.0		1.000	E: 2.0	12.00		-1.0	
S204	24.8	12.1	19.5		1.049	2T:10.0	15.00	0.124	1.9	
Pipe: 65		5.60	19.5	Disch			3.00	120	2.8	
B205	22.5	15.0	0.0		1.000	E: 2.0	12.00		-1.0	
S205	24.8	12.1	19.5		1.049	2T:10.0	15.00	0.124	1.9	
Pipe: 66		5.60	19.8	Disch			3.00	120	2.9	
B206	22.5	15.4	0.0		1.000	E: 2.0	12.00		-1.0	
S206	24.8	12.5	19.8		1.049	2T:10.0	15.00	0.128	1.9	
Pipe: 67		0.0	0.0				3.00	120	1.0	
S207	24.8	16.1	0.0		1.000	E: 2.0	12.00		1.0	
B207	22.5	17.1	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 68		0.0	0.0				3.00	120	1.0	
S208	24.8	17.8	0.0		1.000	E: 2.0	12.00		1.0	
B208	22.5	18.8	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 69		0.0	0.0				3.00	120	1.0	
S209	24.8	18.4	0.0		1.000	E: 2.0	12.00		1.0	
B209	22.5	19.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 70		0.0	0.0				3.00	120	1.0	
S210	24.8	16.5	0.0		1.000	E: 2.0	12.00		1.0	
B210	22.5	17.5	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 71		5.60	19.9	Disch			3.00	120	2.9	
B211	22.5	15.6	0.0		1.000	E: 2.0	12.00		-1.0	
S211	24.8	12.7	19.9		1.049	2T:10.0	15.00	0.129	1.9	
Pipe: 72		5.60	19.6	Disch			3.00	120	2.8	
B212	22.5	15.0	0.0		1.000	E: 2.0	12.00		-1.0	
S212	24.8	12.2	19.6		1.049	2T:10.0	15.00	0.125	1.9	
Pipe: 73		5.60	19.5	Disch			3.00	120	2.8	
B213	22.5	15.0	0.0		1.000	E: 2.0	12.00		-1.0	
S213	24.8	12.2	19.5		1.049	2T:10.0	15.00	0.125	1.9	
Pipe: 74		5.60	19.9	Disch			3.00	120	2.9	
B214	22.5	15.5	0.0		1.000	E: 2.0	12.00		-1.0	
S214	24.8	12.6	19.9		1.049	2T:10.0	15.00	0.128	1.9	
Pipe: 75		0.0	0.0				3.00	120	1.0	
S215	24.8	16.2	0.0		1.000	E: 2.0	12.00		1.0	
B215	22.5	17.2	0.0		1.049	2T:10.0	15.00	0.000	0.0	

Pipe Tag / Frm Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 76		0.0	0.0				3.00	120	1.0	
S216	24.8	17.9	0.0		1.000	E: 2.0	12.00		1.0	
B216	22.5	18.8	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 77		0.0	0.0				3.00	120	1.0	
S217	24.8	21.8	0.0		1.000	E: 2.0	12.00		1.0	
B217	22.5	22.8	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 78		5.60	24.0	Disch			3.00	120	3.7	
B218	22.5	22.0	0.0		1.000	E: 2.0	12.00		-1.0	
S218	24.8	18.3	24.0		1.049	2T:10.0	15.00	0.182	2.7	
Pipe: 79		5.60	24.0	Disch			3.00	120	3.7	
B219	22.5	22.0	0.0		1.000	E: 2.0	12.00		-1.0	
S219	24.8	18.3	24.0		1.049	2T:10.0	15.00	0.182	2.7	
Pipe: 80		0.0	0.0				3.00	120	1.0	
S220	24.8	21.7	0.0		1.000	E: 2.0	12.00		1.0	
B220	22.5	22.7	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 81		0.0	0.0				3.00	120	1.0	
S221	24.8	22.4	0.0		1.000	E: 2.0	12.00		1.0	
B221	22.5	23.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 82		0.0	0.0				3.00	120	1.0	
S222	24.8	23.1	0.0		1.000	E: 2.0	12.00		1.0	
B222	22.5	24.0	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 83		0.0	0.0				3.00	120	1.0	
S223	24.8	23.7	0.0		1.000	E: 2.0	12.00		1.0	
B223	22.5	24.7	0.0		1.049	2T:10.0	15.00	0.000	0.0	

NOTES (HASS):

(1) Calculations were performed by the HASS 8.4 computer program
under license no. 3801093320 granted by
HRS Systems, Inc.
208 Southside Square
Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average
imbalance at each node of 0.002 gpm and a maximum
imbalance at any node of 0.171 gpm.

(3) Total pressure at each node is used in balancing the system.
Maximum water velocity is 10.1 ft/sec at pipe 28.

(4) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

Attachment 2 – Hydraulic Calculation 2 – North Ice Rink

HUGHES ASSOCIATES, INC.
117 METRO CENTER BOULEVARD, SUITE 1002
WARWICK, RI 02886

HYDRAULIC CALCULATIONS FOR
WARWICK MUNICIPAL BUILDINGS
975 SANDY LANE
WARWICK, RI 02889

DRAWING NUMBER: FP-1.2 DATE: SEP 3, 2014

-DESIGN DATA-

REMOTE AREA NUMBER: 2 REMOTE AREA LOCATION: NORTH ICE RINK

OCCUPANCY CLASSIFICATION: LIGHT HAZARD
DENSITY: .1 gpm/sq. ft.
AREA OF APPLICATION: 1530 sq. ft.

COVERAGE PER SPRINKLER: 205 sq. ft.
TYPE OF SPRINKLERS CALCULATED: QUICK RESPONSE K=5.6
NUMBER OF SPRINKLERS CALCULATED: 8

SPRINKLER DEMAND: 165.7 gpm
HOSE-STREAM DEMAND: 100.0 gpm
TOTAL WATER REQUIRED (INCLUDING HOSE): 265.7 gpm
FLOW AND PRESSURE (AT BASE OF RISER): 165.7 gpm @ **45.5** psi

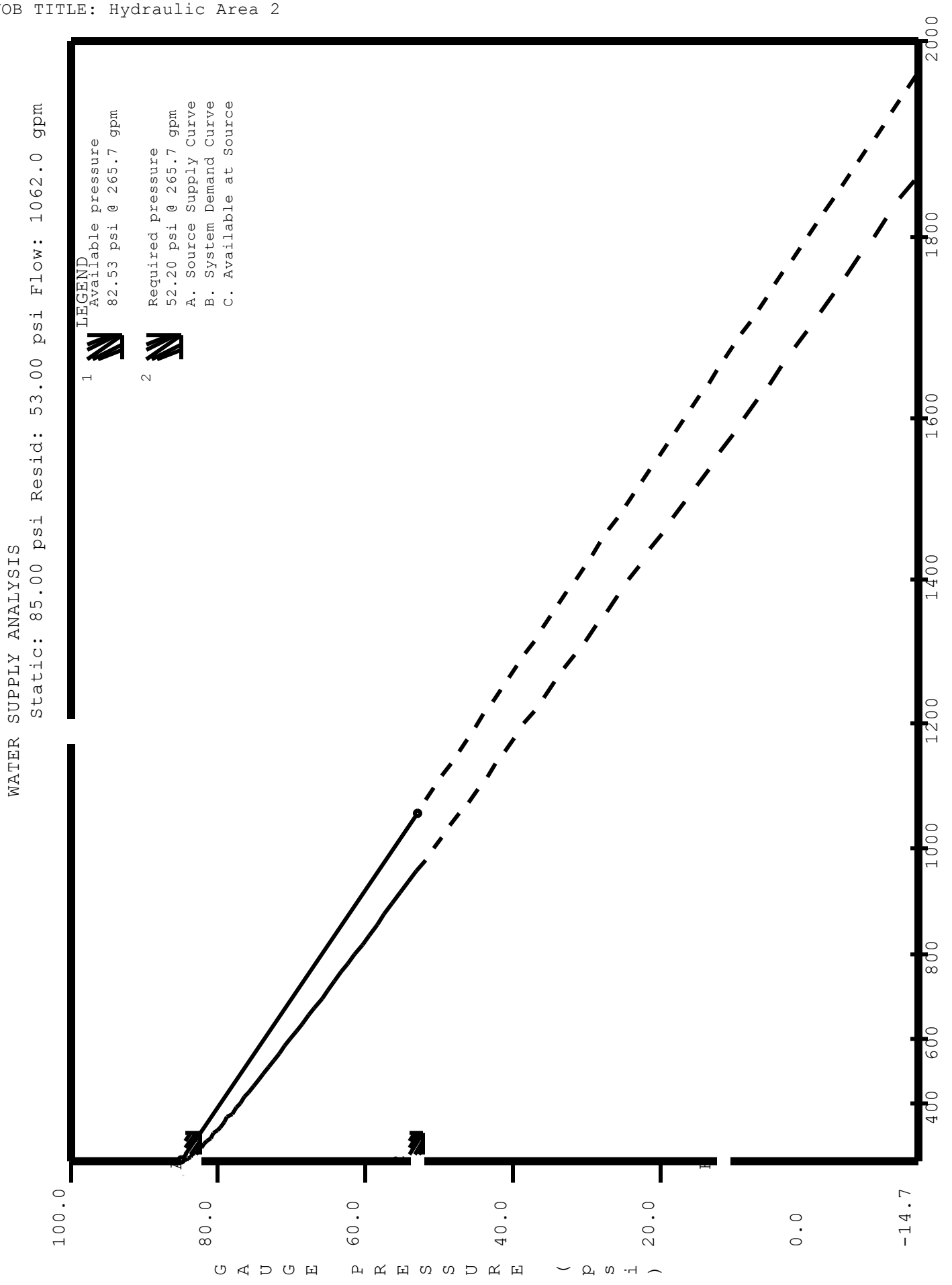
TYPE OF SYSTEM: WET PIPE
DETAILS:

WATER SUPPLY
Source: Municipal Water (8-inch underground)
Test Date: 06-19-2014 Test By: WARWICK WATER DEPT.
Flow Hydrant 6-265 - WHITFORD ST., N. OF INGALLS ST.
Static: 85 psi Residual: 53 psi Flow: 1062 gpm
Source Elevation Relative to Finished Flow Level: 0 ft.

NAME OF DESIGNER: Hughes Associates, Inc.
AUTHORITY HAVING JURISDICTION: WARWICK FIRE DEPARTMENT

Calculations performed by HASS under license # 3801093320 ,
granted by HRS SYSTEMS, INC.
(Notes continue after pipe calculations results.)
(Notes continue after pipe calculations results.)

DATE: 9/3/2014 C:\HASSDATA\ICE RINK 7.SDF
JOB TITLE: Hydraulic Area 2



DATE: 9/3/2014 C:\HASSDATA\ICE RINK 7.SDF
JOB TITLE: Hydraulic Area 2

NFPA WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	@ FLOW (GPM)	AVAIL. PRESS. (PSI)	@ TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SOURCE	85.0	53.0	1062.0	82.5	265.7	52.2

Required pressure is 30.3 psi (37%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	265.7 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	100.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	165.7 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
S5	24.8	K= 5.60	13.4	20.5	
S6	24.8	K= 5.60	13.4	20.5	
S7	24.8	K= 5.60	13.7	20.8	
S8	24.8	- - - -	17.4	- - -	
S9	24.8	- - - -	22.7	- - -	
S10	24.8	- - - -	20.5	- - -	
S11	24.8	- - - -	18.4	- - -	
S12	24.8	K= 5.60	14.1	21.0	
S1	24.8	- - - -	22.4	- - -	
S2	24.8	- - - -	20.3	- - -	
S3	24.8	- - - -	18.2	- - -	
S4	24.8	K= 5.60	14.0	20.9	
S13	24.8	K= 5.60	13.5	20.6	
S14	24.8	K= 5.60	13.5	20.6	
S15	24.8	K= 5.60	13.8	20.8	
S16	24.8	- - - -	17.6	- - -	
S20	24.8	- - - -	19.1	- - -	
S21	24.8	- - - -	19.2	- - -	
S22	24.8	- - - -	20.7	- - -	
S23	24.8	- - - -	20.8	- - -	
S100	11.8	- - - -	36.4	- - -	
S101	11.8	- - - -	36.4	- - -	
S102	11.8	- - - -	36.4	- - -	
S103	11.8	- - - -	36.4	- - -	
S104	11.8	- - - -	36.4	- - -	
S105	11.8	- - - -	36.4	- - -	
S106	11.8	- - - -	36.4	- - -	
S107	11.8	- - - -	36.4	- - -	
S108	11.8	- - - -	36.4	- - -	
S109	11.8	- - - -	36.4	- - -	
S110	11.8	- - - -	36.4	- - -	
S111	11.8	- - - -	36.4	- - -	

DATE: 9/3/2014 C:\HASSDATA\ICE RINK 7.SDF
JOB TITLE: Hydraulic Area 2

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
S112	11.8	- - - -	36.4	- - -	
S113	11.8	- - - -	36.4	- - -	
S114	11.8	- - - -	36.4	- - -	
B114	11.5	- - - -	36.5	- - -	
B115	11.5	- - - -	36.5	- - -	
B116	11.5	- - - -	36.5	- - -	
M101	11.5	- - - -	36.5	- - -	
M102	11.5	- - - -	36.5	- - -	
M103	11.5	- - - -	36.5	- - -	
M100	22.0	- - - -	31.9	- - -	
B20	22.5	- - - -	20.0	- - -	
B21	22.5	- - - -	20.2	- - -	
B22	22.5	- - - -	21.7	- - -	
B23	22.5	- - - -	21.8	- - -	
B1	22.5	- - - -	23.4	- - -	
B2	22.5	- - - -	21.3	- - -	
B3	22.5	- - - -	19.2	- - -	
B4	22.5	- - - -	17.1	- - -	
B5	22.5	- - - -	16.4	- - -	
B6	22.5	- - - -	16.4	- - -	
B7	22.5	- - - -	16.8	- - -	
B8	22.5	- - - -	18.4	- - -	
B9	22.5	- - - -	23.6	- - -	
B10	22.5	- - - -	21.5	- - -	
B11	22.5	- - - -	19.4	- - -	
B12	22.5	- - - -	17.2	- - -	
B13	22.5	- - - -	16.6	- - -	
B14	22.5	- - - -	16.5	- - -	
B15	22.5	- - - -	16.9	- - -	
B16	22.5	- - - -	18.5	- - -	
M10	22.0	- - - -	27.9	- - -	
M11	22.0	- - - -	28.2	- - -	
M17	22.0	- - - -	32.1	- - -	
M9	22.0	- - - -	33.7	- - -	
M1	22.0	- - - -	29.9	- - -	
M2	22.0	- - - -	30.0	- - -	
M8	22.0	- - - -	32.6	- - -	
M3	22.0	- - - -	30.4	- - -	
M4	22.0	- - - -	30.8	- - -	
M5	22.0	- - - -	31.2	- - -	
M6	22.0	- - - -	31.7	- - -	
M7	22.0	- - - -	32.2	- - -	
M12	22.0	- - - -	29.3	- - -	
M13	22.0	- - - -	30.2	- - -	
M14	22.0	- - - -	31.1	- - -	
M15	22.0	- - - -	31.8	- - -	
M16	22.0	- - - -	32.0	- - -	
TOR	22.0	- - - -	36.0	- - -	
BOR	2.0	- - - -	45.5	- - -	
DCVA	2.0	- - - -	50.5	- - -	
UNDG1	-6.0	- - - -	54.7	- - -	
UNDG2	-6.0	- - - -	54.7	- - -	

DATE: 9/3/2014 C:\HASSDATA\ICE RINK 7.SDF
JOB TITLE: Hydraulic Area 2

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
UNDG3	-6.0	- - - -	54.8	- - -	
SOURCE	0.0	SOURCE	52.2	165.7	

NFPA PIPE DATA

Pipe Tag / Frm Node / To Node	El (ft)	K-fac PT	Add Fl (q) Tot.(Q)	Add Fl To Node/ Disch	Nom ID Act ID	Fit: Eq.Ln. (ft.)	L F T	C Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 1		5.60	20.5	Disch			3.00	120	3.0	
B5	22.5	16.4	0.0		1.000	E: 2.0	12.00		-1.0	
S5	24.8	13.4	20.5		1.049	2T:10.0	15.00	0.136	2.0	
Pipe: 2		5.60	20.5	Disch			3.00	120	3.0	
B6	22.5	16.4	0.0		1.000	E: 2.0	12.00		-1.0	
S6	24.8	13.4	20.5		1.049	2T:10.0	15.00	0.136	2.0	
Pipe: 3		5.60	20.8	Disch			3.00	120	3.1	
B7	22.5	16.8	0.0		1.000	E: 2.0	12.00		-1.0	
S7	24.8	13.7	20.8		1.049	2T:10.0	15.00	0.139	2.1	
Pipe: 4		0.0	0.0				3.00	120	1.0	
S8	24.8	17.4	0.0		1.000	E: 2.0	12.00		1.0	
B8	22.5	18.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 5		5.60	20.6	Disch			3.00	120	3.0	
B13	22.5	16.6	0.0		1.000	E: 2.0	12.00		-1.0	
S13	24.8	13.5	20.6		1.049	2T:10.0	15.00	0.137	2.1	
Pipe: 6		5.60	20.6	Disch			3.00	120	3.0	
B14	22.5	16.5	0.0		1.000	E: 2.0	12.00		-1.0	
S14	24.8	13.5	20.6		1.049	2T:10.0	15.00	0.137	2.1	
Pipe: 7		5.60	20.8	Disch			3.00	120	3.1	
B15	22.5	16.9	0.0		1.000	E: 2.0	12.00		-1.0	
S15	24.8	13.8	20.8		1.049	2T:10.0	15.00	0.140	2.1	
Pipe: 8		0.0	0.0				3.00	120	1.0	
S16	24.8	17.6	0.0		1.000	E: 2.0	12.00		1.0	
B16	22.5	18.5	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8A		0.0	0.0				3.00	120	1.0	
S1	24.8	22.4	0.0		1.000	E: 2.0	12.00		1.0	
B1	22.5	23.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8B		0.0	0.0				3.00	120	1.0	
S2	24.8	20.3	0.0		1.000	E: 2.0	12.00		1.0	
B2	22.5	21.3	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8C		0.0	0.0				3.00	120	1.0	
S3	24.8	18.2	0.0		1.000	E: 2.0	12.00		1.0	
B3	22.5	19.2	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8D		5.60	20.9	Disch			3.00	120	3.1	
B4	22.5	17.1	0.0		1.000	E: 2.0	12.00		-1.0	
S4	24.8	14.0	20.9		1.049	2T:10.0	15.00	0.142	2.1	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) / (Pe) / (Pf)	Notes
Pipe: 8E		0.0	0.0				3.00	120	1.0	
S9	24.8	22.7	0.0		1.000	E: 2.0	12.00		1.0	
B9	22.5	23.6	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8F		0.0	0.0				3.00	120	1.0	
S10	24.8	20.5	0.0		1.000	E: 2.0	12.00		1.0	
B10	22.5	21.5	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8G		0.0	0.0				3.00	120	1.0	
S11	24.8	18.4	0.0		1.000	E: 2.0	12.00		1.0	
B11	22.5	19.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8H		5.60	21.0	Disch			3.00	120	3.1	
B12	22.5	17.2	0.0		1.000	E: 2.0	12.00		-1.0	
S12	24.8	14.1	21.0		1.049	2T:10.0	15.00	0.143	2.1	
Pipe: 8I		0.0	0.0				3.00	120	1.0	
S20	24.8	19.1	0.0		1.000	E: 2.0	12.00		1.0	
B20	22.5	20.0	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8J		0.0	0.0				3.00	120	1.0	
S21	24.8	19.2	0.0		1.000	E: 2.0	12.00		1.0	
B21	22.5	20.2	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8K		0.0	0.0				3.00	120	1.0	
S22	24.8	20.7	0.0		1.000	E: 2.0	12.00		1.0	
B22	22.5	21.7	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8L		0.0	0.0				3.00	120	1.0	
S23	24.8	20.8	0.0		1.000	E: 2.0	12.00		1.0	
B23	22.5	21.8	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 9		0.0	0.0				14.16	120	0.0	
B5	22.5	16.4	2.8		1.250	----	0.00		0.0	
B6	22.5	16.4	2.8		1.380		14.16	0.001	0.0	
Pipe: 10		0.0	0.0				14.16	120	0.4	
B7	22.5	16.8	17.7		1.250	----	0.00		0.0	
B6	22.5	16.4	17.7		1.380		14.16	0.027	0.4	
Pipe: 11		0.0	17.7	B6			14.16	120	1.6	
B8	22.5	18.4	20.8	S7	1.250	----	0.00		0.0	
B7	22.5	16.8	38.4		1.380		14.16	0.115	1.6	
Pipe: 12		0.0	0.0				14.16	120	0.0	
B13	22.5	16.6	3.0		1.250	----	0.00		0.0	
B14	22.5	16.5	3.0		1.380		14.16	0.001	0.0	
Pipe: 13		0.0	0.0				14.16	120	0.4	
B15	22.5	16.9	17.6		1.250	----	0.00		0.0	
B14	22.5	16.5	17.6		1.380		14.16	0.027	0.4	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 14		0.0	17.6	B14			14.16	120	1.6	
B16	22.5	18.5	20.8	S15	1.250	----	0.00		0.0	
B15	22.5	16.9	38.4		1.380		14.16	0.114	1.6	
Pipe: 14A		0.0	0.0				14.16	120	2.1	
B1	22.5	23.4	44.3	B3	1.250	----	0.00		0.0	
B2	22.5	21.3	44.3		1.380		14.16	0.149	2.1	
Pipe: 14B		0.0	0.0				14.16	120	2.1	
B2	22.5	21.3	44.3	B4	1.250	----	0.00		0.0	
B3	22.5	19.2	44.3		1.380		14.16	0.149	2.1	
Pipe: 14C		0.0	23.3	B5			14.16	120	2.1	
B3	22.5	19.2	20.9	S4	1.250	----	0.00		0.0	
B4	22.5	17.1	44.3		1.380		14.16	0.149	2.1	
Pipe: 14D		0.0	2.8	B6			14.16	120	0.6	
B4	22.5	17.1	20.5	S5	1.250	----	0.00		0.0	
B5	22.5	16.4	23.3		1.380		14.16	0.046	0.6	
Pipe: 14E		0.0	0.0				14.16	120	2.1	
B9	22.5	23.6	44.6	B11	1.250	----	0.00		0.0	
B10	22.5	21.5	44.6		1.380		14.16	0.151	2.1	
Pipe: 14F		0.0	0.0				14.16	120	2.1	
B10	22.5	21.5	44.6	B12	1.250	----	0.00		0.0	
B11	22.5	19.4	44.6		1.380		14.16	0.151	2.1	
Pipe: 14G		0.0	23.6	B13			14.16	120	2.1	
B11	22.5	19.4	21.0	S12	1.250	----	0.00		0.0	
B12	22.5	17.2	44.6		1.380		14.16	0.151	2.1	
Pipe: 14H		0.0	3.0	B14			14.16	120	0.7	
B12	22.5	17.2	20.6	S13	1.250	----	0.00		0.0	
B13	22.5	16.6	23.6		1.380		14.16	0.047	0.7	
Pipe: 14I		0.0	0.0				14.16	120	1.6	
B22	22.5	21.7	38.4	B8	1.250	----	0.00		0.0	
B20	22.5	20.0	38.4		1.380		14.16	0.115	1.6	
Pipe: 14J		0.0	0.0				14.16	120	1.6	
B23	22.5	21.8	38.4	B16	1.250	----	0.00		0.0	
B21	22.5	20.2	38.4		1.380		14.16	0.114	1.6	
Pipe: 14K		0.0	0.0				61.42	120	8.3	
M1	22.0	29.9	38.4	B20	1.250	E: 3.0	9.00		-0.2	
B22	22.5	21.7	38.4		1.380	T: 6.0	70.42	0.115	8.1	
Pipe: 14L		0.0	0.0				61.42	120	8.3	
M2	22.0	30.0	38.4	B21	1.250	E: 3.0	9.00		-0.2	
B23	22.5	21.8	38.4		1.380	T: 6.0	70.42	0.114	8.1	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 15		0.0	0.0				20.12	120	4.6	
M10	22.0	27.9	44.3	B2	1.250	E: 3.0	9.00		-0.2	
B1	22.5	23.4	44.3		1.380	T: 6.0	29.12	0.149	4.3	
Pipe: 16		0.0	0.0				20.12	120	4.6	
M11	22.0	28.2	44.6	B10	1.250	E: 3.0	9.00		-0.2	
B9	22.5	23.6	44.6		1.380	T: 6.0	29.12	0.151	4.4	
Pipe: 17		0.0	0.0				14.16	120	1.6	
B21	22.5	20.2	38.4	B15	1.250	----	0.00		0.0	
B16	22.5	18.5	38.4		1.380		14.16	0.114	1.6	
Pipe: 18		0.0	0.0				14.16	120	1.6	
B20	22.5	20.0	38.4	B7	1.250	----	0.00		0.0	
B8	22.5	18.4	38.4		1.380		14.16	0.115	1.6	
Pipe: 20		0.0	0.0				14.33	120	0.1	
M2	22.0	30.0	38.4	B22	2.500	----	0.00		0.0	
M1	22.0	29.9	38.4		2.469		14.33	0.007	0.1	
Pipe: 21		0.0	0.0				14.33	120	0.3	
M11	22.0	28.2	44.3	B1	2.000	----	0.00		0.0	
M10	22.0	27.9	44.3		2.067		14.33	0.021	0.3	
Pipe: 22		0.0	44.3	M10			14.29	120	1.1	
M12	22.0	29.3	44.6	B9	2.000	----	0.00		0.0	
M11	22.0	28.2	88.9		2.067		14.29	0.076	1.1	
Pipe: 23		0.0	88.9	M11			13.96	120	0.9	
M13	22.0	30.2	-6.8	M3	2.000	----	0.00		0.0	
M12	22.0	29.3	82.1		2.067		13.96	0.065	0.9	
Pipe: 24		0.0	82.1	M12			13.96	120	0.8	
M14	22.0	31.1	-4.8	M4	2.000	----	0.00		0.0	
M13	22.0	30.2	77.3		2.067		13.96	0.058	0.8	
Pipe: 25		0.0	77.3	M13			14.29	120	0.8	
M15	22.0	31.8	-2.6	M5	2.000	----	0.00		0.0	
M14	22.0	31.1	74.7		2.067		14.29	0.055	0.8	
Pipe: 26		0.0	76.9	M15			10.42	120	0.1	
M16	22.0	32.0	0.0	M101	3.000	----	0.00		0.0	
M100	22.0	31.9	76.9		3.068		10.42	0.008	0.1	
Pipe: 27		0.0	76.9	M100			6.08	120	0.1	
M17	22.0	32.1	-2.3	M7	3.000	E: 7.0	7.00		0.0	
M16	22.0	32.0	74.6		3.068		13.08	0.008	0.1	
Pipe: 28		0.0	38.4	M1			14.29	120	0.3	
M3	22.0	30.4	38.4	B23	2.500	----	0.00		0.0	
M2	22.0	30.0	76.8		2.469		14.29	0.024	0.3	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) / (Pe) / (Pf)	Notes
Pipe: 29		0.0	6.8	M12			13.96	120	0.4	
M4	22.0	30.8	76.8	M2	2.500	----	0.00		0.0	
M3	22.0	30.4	83.7		2.469		13.96	0.028	0.4	
Pipe: 30		0.0	4.8	M13			13.96	120	0.4	
M5	22.0	31.2	83.7	M3	2.500	----	0.00		0.0	
M4	22.0	30.8	88.5		2.469		13.96	0.032	0.4	
Pipe: 31		0.0	2.6	M14			14.29	120	0.5	
M6	22.0	31.7	88.5	M4	2.500	----	0.00		0.0	
M5	22.0	31.2	91.0		2.469		14.29	0.033	0.5	
Pipe: 32		0.0	91.0	M5			14.29	120	0.5	
M7	22.0	32.2	-2.2	M15	2.500	----	0.00		0.0	
M6	22.0	31.7	88.8		2.469		14.29	0.032	0.5	
Pipe: 33		0.0	2.3	M16			6.08	120	0.4	
M8	22.0	32.6	88.8	M6	2.500	E: 6.0	6.00		0.0	
M7	22.0	32.2	91.1		2.469		12.08	0.033	0.4	
Pipe: 34		0.0	88.9	M11			207.92	120	1.1	
M3	22.0	30.4	-82.1	M13	1.250	2E: 6.0	18.00		0.0	
M12	22.0	29.3	6.8		1.380	2T:12.0	225.92	0.005	1.1	
Pipe: 35		0.0	82.1	M12			207.92	120	0.6	
M4	22.0	30.8	-77.3	M14	1.250	2E: 6.0	18.00		0.0	
M13	22.0	30.2	4.8		1.380	2T:12.0	225.92	0.002	0.6	
Pipe: 36		0.0	77.3	M13			207.92	120	0.2	
M5	22.0	31.2	-74.7	M15	1.250	2E: 6.0	18.00		0.0	
M14	22.0	31.1	2.6		1.380	2T:12.0	225.92	0.001	0.2	
Pipe: 37		0.0	91.0	M5			207.92	120	0.1	
M15	22.0	31.8	-88.8	M7	1.250	2E: 6.0	18.00		0.0	
M6	22.0	31.7	2.2		1.380	2T:12.0	225.92	0.001	0.1	
Pipe: 38		0.0	76.9	M100			207.92	120	0.1	
M7	22.0	32.2	-74.6	M17	1.250	2E: 6.0	18.00		0.0	
M16	22.0	32.0	2.3		1.380	2T:12.0	225.92	0.001	0.1	
Pipe: 40		0.0	0.0				22.58	120	1.2	
M9	22.0	33.7	91.1	M7	2.500	T:12.0	12.00		0.0	
M8	22.0	32.6	91.1		2.469		34.58	0.033	1.2	
Pipe: 41		0.0	74.6	M17			213.42	120	2.3	
TOR	22.0	36.0	91.1	M8	4.000	3E:30.0	30.00		0.0	
M9	22.0	33.7	165.7		4.026		243.42	0.009	2.3	
Pipe: 42		0.0	0.0			2ETCB	22.00	120	9.6	
BOR	2.0	45.5	165.7	M9	4.000		74.00		-8.7	
TOR	22.0	36.0	165.7		4.026		96.00	0.009	0.9	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 44		0.0	0.0				19.96	120	4.5	
M100	22.0	31.9	0.0		3.000	2E:14.0	29.00		4.5	
M101	11.5	36.5	0.0		3.068	T:15.0	48.96	0.000	0.0	
Pipe: 45		0.0	0.0				11.17	120	0.0	
M102	11.5	36.5	0.0		2.500	----	0.00		0.0	
M101	11.5	36.5	0.0		2.469		11.17	0.000	0.0	
Pipe: 46		0.0	0.0				11.17	120	0.0	
M103	11.5	36.5	0.0		2.500	----	0.00		0.0	
M102	11.5	36.5	0.0		2.469		11.17	0.000	0.0	
Pipe: 47		0.0	0.0				2.50	120	0.0	
B116	11.5	36.5	0.0		2.000	E: 5.0	15.00		0.0	
M101	11.5	36.5	0.0		2.067	T:10.0	17.50	0.000	0.0	
Pipe: 47A		0.0	0.0				10.50	120	0.1	
B116	11.5	36.5	0.0		1.500	----	0.00		-0.1	
S114	11.8	36.4	0.0		1.610		10.50	0.000	0.0	
Pipe: 47B		0.0	0.0				10.50	120	0.0	
S111	11.8	36.4	0.0		1.500	----	0.00		0.0	
S114	11.8	36.4	0.0		1.610		10.50	0.000	0.0	
Pipe: 48		0.0	0.0				2.50	120	0.0	
B115	11.5	36.5	0.0		2.000	E: 5.0	15.00		0.0	
M102	11.5	36.5	0.0		2.067	T:10.0	17.50	0.000	0.0	
Pipe: 48A		0.0	0.0				10.50	120	0.1	
B115	11.5	36.5	0.0		1.500	----	0.00		-0.1	
S113	11.8	36.4	0.0		1.610		10.50	0.000	0.0	
Pipe: 48B		0.0	0.0				10.50	120	0.0	
S107	11.8	36.4	0.0		1.500	----	0.00		0.0	
S113	11.8	36.4	0.0		1.610		10.50	0.000	0.0	
Pipe: 49		0.0	0.0				2.50	120	0.0	
B114	11.5	36.5	0.0		2.000	E: 5.0	15.00		0.0	
M103	11.5	36.5	0.0		2.067	T:10.0	17.50	0.000	0.0	
Pipe: 49A		0.0	0.0				10.50	120	0.1	
B114	11.5	36.5	0.0		1.500	----	0.00		-0.1	
S112	11.8	36.4	0.0		1.610		10.50	0.000	0.0	
Pipe: 49B		0.0	0.0				10.50	120	0.0	
S103	11.8	36.4	0.0		1.500	----	0.00		0.0	
S112	11.8	36.4	0.0		1.610		10.50	0.000	0.0	
Pipe: 50		0.0	0.0				10.50	120	0.0	
S110	11.8	36.4	0.0		1.250	----	0.00		0.0	
S111	11.8	36.4	0.0		1.380		10.50	0.000	0.0	

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JOB TITLE: Hydraulic Area 2

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 51		0.0	0.0				10.50	120	0.0	
S106	11.8	36.4	0.0		1.250	----	0.00		0.0	
S107	11.8	36.4	0.0		1.380		10.50	0.000	0.0	
Pipe: 52		0.0	0.0				10.50	120	0.0	
S102	11.8	36.4	0.0		1.250	----	0.00		0.0	
S103	11.8	36.4	0.0		1.380		10.50	0.000	0.0	
Pipe: 53		0.0	0.0				10.50	120	0.0	
S109	11.8	36.4	0.0		1.250	----	0.00		0.0	
S110	11.8	36.4	0.0		1.380		10.50	0.000	0.0	
Pipe: 54		0.0	0.0				10.50	120	0.0	
S105	11.8	36.4	0.0		1.250	----	0.00		0.0	
S106	11.8	36.4	0.0		1.380		10.50	0.000	0.0	
Pipe: 55		0.0	0.0				10.50	120	0.0	
S101	11.8	36.4	0.0		1.250	----	0.00		0.0	
S102	11.8	36.4	0.0		1.380		10.50	0.000	0.0	
Pipe: 56		0.0	0.0				10.50	120	0.0	
S108	11.8	36.4	0.0		1.000	----	0.00		0.0	
S109	11.8	36.4	0.0		1.049		10.50	0.000	0.0	
Pipe: 57		0.0	0.0				10.50	120	0.0	
S104	11.8	36.4	0.0		1.000	----	0.00		0.0	
S105	11.8	36.4	0.0		1.049		10.50	0.000	0.0	
Pipe: 58		0.0	0.0				10.50	120	0.0	
S100	11.8	36.4	0.0		1.000	----	0.00		0.0	
S101	11.8	36.4	0.0		1.049		10.50	0.000	0.0	
Pipe: 59		0.0	0.0				184.33	120	1.6	
M9	22.0	33.7	74.6	M16	3.000	T:15.0	15.00		0.0	
M17	22.0	32.1	74.6		3.068		199.33	0.008	1.6	
Pipe: 60		0.0	2.2	M6			3.83	120	0.1	
M100	22.0	31.9	74.7	M14	2.500	----	0.00		0.0	
M15	22.0	31.8	76.9		2.469		3.83	0.024	0.1	
Pipe: 60A			0.0	Fixed Pressure Loss Device						
DCVA	2.0	50.5	165.7	TOR	5.0 psi, 165.7 gpm					
BOR	2.0	45.5	165.7							
Pipe: 61		0.0	0.0			2E:34.0	50.00	140	4.1	
UNDG1	-6.0	54.7	165.7	BOR	D4.000	T:34.0	71.00		-3.5	
DCVA	2.0	50.5	165.7		4.220	G: 3.0	121.00	0.006	0.7	
Pipe: 62		0.0	0.0				100.00	150	0.0	
UNDG2	-6.0	54.7	165.7	DCVA	8.000	G: 7.0	7.02		0.0	
UNDG1	-6.0	54.7	165.7		8.230		107.02	0.000	0.0	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 63		0.0	0.0			E:31.6	215.00	150	0.1	
UNDG3	-6.0	54.8	165.7	UNDG1	8.000	T:61.4	100.03		0.0	
UNDG2	-6.0	54.7	165.7		8.230	G: 7.0	315.03	0.000	0.1	
Pipe: 64		Source	0.0			E:27.0	90.00	150	2.5	
SOURCE	0.0	52.2	165.7	UNDG2	8.000	2T106.0	139.00		2.6	
UNDG3	-6.0	54.8	165.7		7.980	G: 6.0	229.00	0.000	0.1	

NOTES (HASS):

(1) Calculations were performed by the HASS 8.4 computer program
under license no. 3801093320 granted by
HRS Systems, Inc.
208 Southside Square
Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average
imbalance at each node of 0.002 gpm and a maximum
imbalance at any node of 0.166 gpm.

(3) Total pressure at each node is used in balancing the system.
Maximum water velocity is 9.6 ft/sec at pipe 14E.

(4) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

(5) Available pressure at source node SOURCE under full flow conditions is
81.41 psi compared to the minimum required pressure of 20.00 psi.

(6) PIPE FITTINGS TABLE

Pipe Table Name: STANDARD.PIP

PAGE: * MATERIAL: S40 HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
8.230	20.91	40.65	15.10	52.26	13.94	4.65	36.00	36.00	40.65

Attachment 3 – Hydraulic Calculation 3 – Refrigeration Room

HUGHES ASSOCIATES, INC.
117 METRO CENTER BOULEVARD, SUITE 1002
WARWICK, RI 02886

HYDRAULIC CALCULATIONS FOR
WARWICK MUNICIPAL BUILDINGS
975 SANDY LANE
WARWICK, RI 02889

DRAWING NUMBER: FP-1.1 DATE: SEP 3, 2014

-DESIGN DATA-

REMOTE AREA NUMBER: 1 REMOTE AREA LOCATION: SOUTH ICE RINK

OCCUPANCY CLASSIFICATION: LIGHT HAZARD
DENSITY: .1 gpm/sq. ft.
AREA OF APPLICATION: 1610 sq. ft.

COVERAGE PER SPRINKLER: 195 sq. ft.
TYPE OF SPRINKLERS CALCULATED: QUICK RESPONSE K=5.6
NUMBER OF SPRINKLERS CALCULATED: 10

SPRINKLER DEMAND: 205.5 gpm
HOSE-STREAM DEMAND: 100.0 gpm
TOTAL WATER REQUIRED (INCLUDING HOSE): 305.6 gpm
FLOW AND PRESSURE (AT BASE OF RISER): 205.5 gpm @ **51.2** psi

TYPE OF SYSTEM: WET PIPE
DETAILS:

WATER SUPPLY
Source: Municipal Water (8-inch underground)
Test Date: 06-19-2014 Test By: WARWICK WATER DEPT.
Flow Hydrant 6-265 - WHITFORD ST., N. OF INGALLS ST.
Static: 85 psi Residual: 53 psi Flow: 1062 gpm
Source Elevation Relative to Finished Flow Level: 0 ft.

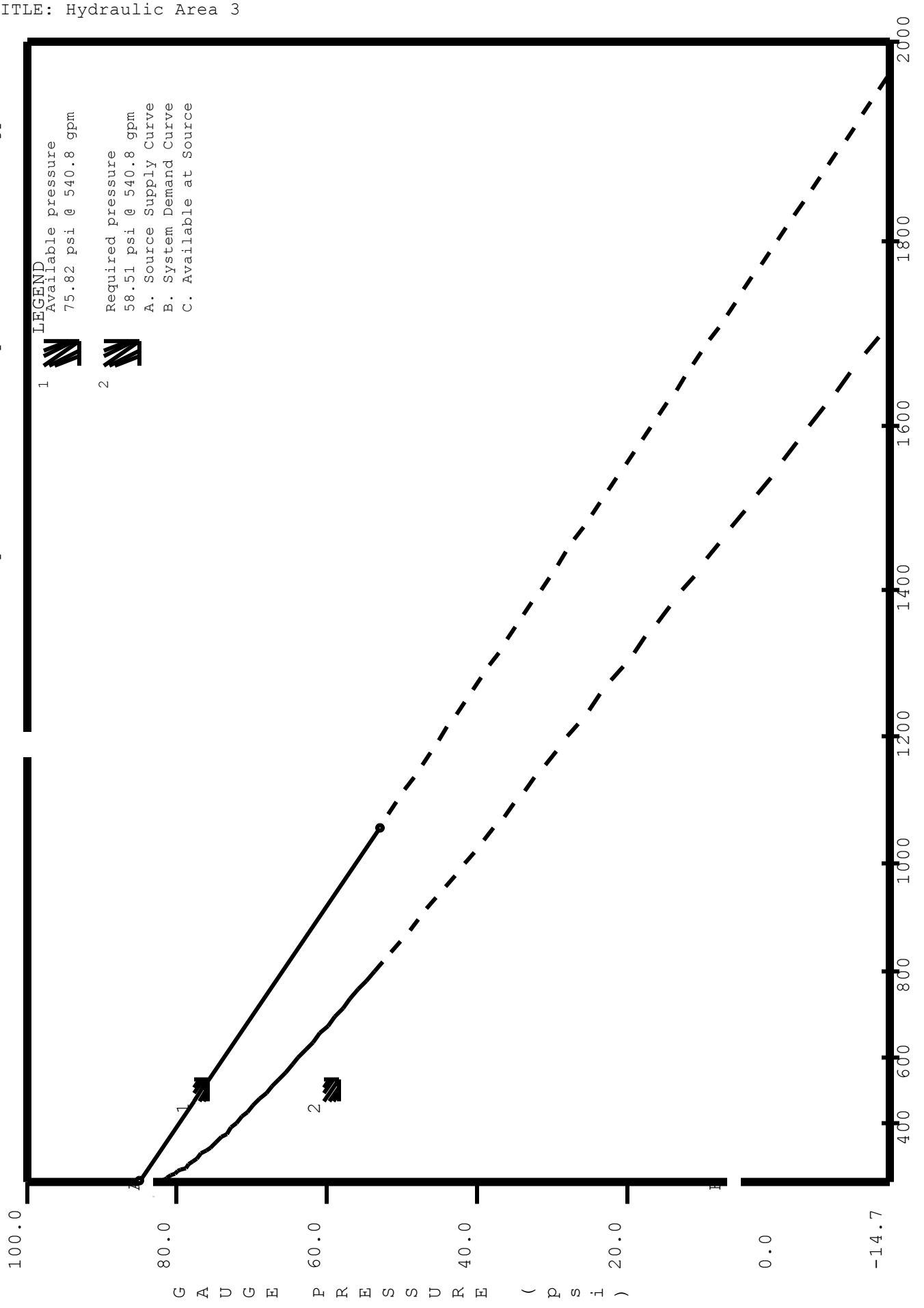
NAME OF DESIGNER: Hughes Associates, Inc.
AUTHORITY HAVING JURISDICTION: WARWICK FIRE DEPARTMENT

Calculations performed by HASS under license # 3801093320 ,
granted by HRS SYSTEMS, INC.

(Notes continue after pipe calculations results.)
(Notes continue after pipe calculations results.)

DATE: 9/3/2014 C:\HASSDATA\ICE RINK 8.SDF
JOB TITLE: Hydraulic Area 3

WATER SUPPLY ANALYSIS
Static: 85.00 psi Resid: 53.00 psi Flow: 1062.0 gpm



DATE: 9/3/2014 C:\HASSDATA\ICE RINK 8.SDF
JOB TITLE: Hydraulic Area 3

NFPA WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	@ FLOW (GPM)	AVAIL. PRESS. (PSI)	@ TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SOURCE	85.0	53.0	1062.0	75.8	540.8	58.5

Required pressure is 17.3 psi (23%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	540.8 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	290.8 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
S5	24.8	- - - -	25.7	- - -	
S6	24.8	- - - -	25.9	- - -	
S7	24.8	- - - -	26.2	- - -	
S8	24.8	- - - -	26.4	- - -	
S9	24.8	- - - -	24.7	- - -	
S10	24.8	- - - -	24.9	- - -	
S11	24.8	- - - -	25.2	- - -	
S12	24.8	- - - -	25.4	- - -	
S1	24.8	- - - -	24.7	- - -	
S2	24.8	- - - -	24.9	- - -	
S3	24.8	- - - -	25.2	- - -	
S4	24.8	- - - -	25.4	- - -	
S13	24.8	- - - -	25.7	- - -	
S14	24.8	- - - -	25.9	- - -	
S15	24.8	- - - -	26.2	- - -	
S16	24.8	- - - -	26.4	- - -	
S20	24.8	- - - -	26.7	- - -	
S21	24.8	- - - -	26.7	- - -	
S22	24.8	- - - -	26.9	- - -	
S23	24.8	- - - -	26.9	- - -	
S100	11.8	K= 5.60	9.8	17.5	
S101	11.8	K= 5.60	10.8	18.4	
S102	11.8	K= 5.60	11.9	19.3	
S103	11.8	K= 5.60	14.2	21.1	
S104	11.8	K= 5.60	10.0	17.7	
S105	11.8	K= 5.60	11.1	18.6	
S106	11.8	K= 5.60	12.1	19.5	
S107	11.8	K= 5.60	14.5	21.4	
S108	11.8	- - - -	15.3	- - -	
S109	11.8	K= 5.60	15.3	21.9	
S110	11.8	K= 5.60	15.8	22.2	
S111	11.8	K= 5.60	17.3	23.3	

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JOB TITLE: Hydraulic Area 3

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
S112	11.8	K= 5.60	16.3	22.6	
S113	11.8	K= 5.60	16.6	22.8	
S114	11.8	K= 5.60	18.9	24.4	
B114	11.5	- - - -	19.6	- - -	
B115	11.5	- - - -	20.0	- - -	
B116	11.5	- - - -	21.9	- - -	
M101	11.5	- - - -	23.3	- - -	
M102	11.5	- - - -	21.7	- - -	
M103	11.5	- - - -	21.3	- - -	
M100	22.0	- - - -	23.6	- - -	
B20	22.5	- - - -	27.7	- - -	
B21	22.5	- - - -	27.7	- - -	
B22	22.5	- - - -	27.9	- - -	
B23	22.5	- - - -	27.9	- - -	
B1	22.5	- - - -	25.7	- - -	
B2	22.5	- - - -	25.9	- - -	
B3	22.5	- - - -	26.2	- - -	
B4	22.5	- - - -	26.4	- - -	
B5	22.5	- - - -	26.7	- - -	
B6	22.5	- - - -	26.9	- - -	
B7	22.5	- - - -	27.2	- - -	
B8	22.5	- - - -	27.4	- - -	
B9	22.5	- - - -	25.6	- - -	
B10	22.5	- - - -	25.9	- - -	
B11	22.5	- - - -	26.1	- - -	
B12	22.5	- - - -	26.4	- - -	
B13	22.5	- - - -	26.6	- - -	
B14	22.5	- - - -	26.9	- - -	
B15	22.5	- - - -	27.2	- - -	
B16	22.5	- - - -	27.4	- - -	
M10	22.0	- - - -	25.4	- - -	
M11	22.0	- - - -	25.3	- - -	
M17	22.0	- - - -	24.6	- - -	
M9	22.0	- - - -	32.8	- - -	
M1	22.0	- - - -	29.4	- - -	
M2	22.0	- - - -	29.4	- - -	
M8	22.0	- - - -	31.1	- - -	
M3	22.0	- - - -	29.4	- - -	
M4	22.0	- - - -	29.6	- - -	
M5	22.0	- - - -	29.8	- - -	
M6	22.0	- - - -	30.1	- - -	
M7	22.0	- - - -	30.6	- - -	
M12	22.0	- - - -	25.2	- - -	
M13	22.0	- - - -	24.9	- - -	
M14	22.0	- - - -	24.5	- - -	
M15	22.0	- - - -	23.7	- - -	
M16	22.0	- - - -	24.1	- - -	
TOR	22.0	- - - -	39.2	- - -	
BOR	2.0	- - - -	50.4	- - -	
DCVA	2.0	- - - -	55.4	- - -	
UNDG1	-6.0	- - - -	60.7	- - -	
UNDG2	-6.0	- - - -	60.8	- - -	

DATE: 9/3/2014 C:\HASSDATA\ICE RINK 8.SDF
JOB TITLE: Hydraulic Area 3

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
UNDG3	-6.0	- - - -	61.0	- - -	
SOURCE	0.0	SOURCE	58.5	290.8	

NFPA PIPE DATA

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 1		0.0	0.0				3.00	120	1.0	
S5	24.8	25.7	0.0		1.000	E: 2.0	12.00		1.0	
B5	22.5	26.7	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 2		0.0	0.0				3.00	120	1.0	
S6	24.8	25.9	0.0		1.000	E: 2.0	12.00		1.0	
B6	22.5	26.9	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 3		0.0	0.0				3.00	120	1.0	
S7	24.8	26.2	0.0		1.000	E: 2.0	12.00		1.0	
B7	22.5	27.2	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 4		0.0	0.0				3.00	120	1.0	
S8	24.8	26.4	0.0		1.000	E: 2.0	12.00		1.0	
B8	22.5	27.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 5		0.0	0.0				3.00	120	1.0	
S13	24.8	25.7	0.0		1.000	E: 2.0	12.00		1.0	
B13	22.5	26.6	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 6		0.0	0.0				3.00	120	1.0	
S14	24.8	25.9	0.0		1.000	E: 2.0	12.00		1.0	
B14	22.5	26.9	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 7		0.0	0.0				3.00	120	1.0	
S15	24.8	26.2	0.0		1.000	E: 2.0	12.00		1.0	
B15	22.5	27.2	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8		0.0	0.0				3.00	120	1.0	
S16	24.8	26.4	0.0		1.000	E: 2.0	12.00		1.0	
B16	22.5	27.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8A		0.0	0.0				3.00	120	1.0	
S1	24.8	24.7	0.0		1.000	E: 2.0	12.00		1.0	
B1	22.5	25.7	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8B		0.0	0.0				3.00	120	1.0	
S2	24.8	24.9	0.0		1.000	E: 2.0	12.00		1.0	
B2	22.5	25.9	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8C		0.0	0.0				3.00	120	1.0	
S3	24.8	25.2	0.0		1.000	E: 2.0	12.00		1.0	
B3	22.5	26.2	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8D		0.0	0.0				3.00	120	1.0	
S4	24.8	25.4	0.0		1.000	E: 2.0	12.00		1.0	
B4	22.5	26.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 8E		0.0	0.0				3.00	120	1.0	
S9	24.8	24.7	0.0		1.000	E: 2.0	12.00		1.0	
B9	22.5	25.6	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8F		0.0	0.0				3.00	120	1.0	
S10	24.8	24.9	0.0		1.000	E: 2.0	12.00		1.0	
B10	22.5	25.9	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8G		0.0	0.0				3.00	120	1.0	
S11	24.8	25.2	0.0		1.000	E: 2.0	12.00		1.0	
B11	22.5	26.1	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8H		0.0	0.0				3.00	120	1.0	
S12	24.8	25.4	0.0		1.000	E: 2.0	12.00		1.0	
B12	22.5	26.4	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8I		0.0	0.0				3.00	120	1.0	
S20	24.8	26.7	0.0		1.000	E: 2.0	12.00		1.0	
B20	22.5	27.7	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8J		0.0	0.0				3.00	120	1.0	
S21	24.8	26.7	0.0		1.000	E: 2.0	12.00		1.0	
B21	22.5	27.7	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8K		0.0	0.0				3.00	120	1.0	
S22	24.8	26.9	0.0		1.000	E: 2.0	12.00		1.0	
B22	22.5	27.9	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 8L		0.0	0.0				3.00	120	1.0	
S23	24.8	26.9	0.0		1.000	E: 2.0	12.00		1.0	
B23	22.5	27.9	0.0		1.049	2T:10.0	15.00	0.000	0.0	
Pipe: 9		0.0	0.0				14.16	120	0.2	
B6	22.5	26.9	14.0	B4	1.250	----	0.00		0.0	
B5	22.5	26.7	14.0		1.380		14.16	0.018	0.2	
Pipe: 10		0.0	0.0				14.16	120	0.2	
B7	22.5	27.2	14.0	B5	1.250	----	0.00		0.0	
B6	22.5	26.9	14.0		1.380		14.16	0.018	0.2	
Pipe: 11		0.0	0.0				14.16	120	0.2	
B8	22.5	27.4	14.0	B6	1.250	----	0.00		0.0	
B7	22.5	27.2	14.0		1.380		14.16	0.018	0.2	
Pipe: 12		0.0	0.0				14.16	120	0.3	
B14	22.5	26.9	14.1	B12	1.250	----	0.00		0.0	
B13	22.5	26.6	14.1		1.380		14.16	0.018	0.3	
Pipe: 13		0.0	0.0				14.16	120	0.3	
B15	22.5	27.2	14.1	B13	1.250	----	0.00		0.0	
B14	22.5	26.9	14.1		1.380		14.16	0.018	0.3	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) / (Pe) / (Pf)	Notes
Pipe: 14		0.0	0.0				14.16	120	0.3	
B16	22.5	27.4	14.1	B14	1.250	----	0.00		0.0	
B15	22.5	27.2	14.1		1.380		14.16	0.018	0.3	
Pipe: 14A		0.0	0.0				14.16	120	0.2	
B2	22.5	25.9	14.0	M10	1.250	----	0.00		0.0	
B1	22.5	25.7	14.0		1.380		14.16	0.018	0.2	
Pipe: 14B		0.0	0.0				14.16	120	0.2	
B3	22.5	26.2	14.0	B1	1.250	----	0.00		0.0	
B2	22.5	25.9	14.0		1.380		14.16	0.018	0.2	
Pipe: 14C		0.0	0.0				14.16	120	0.2	
B4	22.5	26.4	14.0	B2	1.250	----	0.00		0.0	
B3	22.5	26.2	14.0		1.380		14.16	0.018	0.2	
Pipe: 14D		0.0	0.0				14.16	120	0.2	
B5	22.5	26.7	14.0	B3	1.250	----	0.00		0.0	
B4	22.5	26.4	14.0		1.380		14.16	0.018	0.2	
Pipe: 14E		0.0	0.0				14.16	120	0.3	
B10	22.5	25.9	14.1	M11	1.250	----	0.00		0.0	
B9	22.5	25.6	14.1		1.380		14.16	0.018	0.3	
Pipe: 14F		0.0	0.0				14.16	120	0.3	
B11	22.5	26.1	14.1	B9	1.250	----	0.00		0.0	
B10	22.5	25.9	14.1		1.380		14.16	0.018	0.3	
Pipe: 14G		0.0	0.0				14.16	120	0.3	
B12	22.5	26.4	14.1	B10	1.250	----	0.00		0.0	
B11	22.5	26.1	14.1		1.380		14.16	0.018	0.3	
Pipe: 14H		0.0	0.0				14.16	120	0.3	
B13	22.5	26.6	14.1	B11	1.250	----	0.00		0.0	
B12	22.5	26.4	14.1		1.380		14.16	0.018	0.3	
Pipe: 14I		0.0	0.0				14.16	120	0.2	
B22	22.5	27.9	14.0	B8	1.250	----	0.00		0.0	
B20	22.5	27.7	14.0		1.380		14.16	0.018	0.2	
Pipe: 14J		0.0	0.0				14.16	120	0.3	
B23	22.5	27.9	14.1	B16	1.250	----	0.00		0.0	
B21	22.5	27.7	14.1		1.380		14.16	0.018	0.3	
Pipe: 14K		0.0	0.0				61.42	120	1.5	
M1	22.0	29.4	14.0	B20	1.250	E: 3.0	9.00		-0.2	
B22	22.5	27.9	14.0		1.380	T: 6.0	70.42	0.018	1.2	
Pipe: 14L		0.0	0.0				61.42	120	1.5	
M2	22.0	29.4	14.1	B21	1.250	E: 3.0	9.00		-0.2	
B23	22.5	27.9	14.1		1.380	T: 6.0	70.42	0.018	1.3	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 15		0.0	0.0				20.12	120	0.3	
B1	22.5	25.7	14.0	M11	1.250	E: 3.0	9.00		0.2	
M10	22.0	25.4	14.0		1.380	T: 6.0	29.12	0.018	0.5	
Pipe: 16		0.0	28.1	M12			20.12	120	0.3	
B9	22.5	25.6	-14.0	M10	1.250	E: 3.0	9.00		0.2	
M11	22.0	25.3	14.1		1.380	T: 6.0	29.12	0.018	0.5	
Pipe: 17		0.0	0.0				14.16	120	0.3	
B21	22.5	27.7	14.1	B15	1.250	----	0.00		0.0	
B16	22.5	27.4	14.1		1.380		14.16	0.018	0.3	
Pipe: 18		0.0	0.0				14.16	120	0.2	
B20	22.5	27.7	14.0	B7	1.250	----	0.00		0.0	
B8	22.5	27.4	14.0		1.380		14.16	0.018	0.2	
Pipe: 20		0.0	0.0				14.33	120	0.0	
M2	22.0	29.4	14.0	B22	2.500	----	0.00		0.0	
M1	22.0	29.4	14.0		2.469		14.33	0.001	0.0	
Pipe: 21		0.0	28.1	M12			14.33	120	0.0	
M10	22.0	25.4	-14.1	B9	2.000	----	0.00		0.0	
M11	22.0	25.3	14.0		2.067		14.33	0.002	0.0	
Pipe: 22		0.0	42.5	M13			14.29	120	0.1	
M11	22.0	25.3	-14.5	M3	2.000	----	0.00		0.0	
M12	22.0	25.2	28.1		2.067		14.29	0.009	0.1	
Pipe: 23		0.0	57.7	M14			13.96	120	0.3	
M12	22.0	25.2	-15.1	M4	2.000	----	0.00		0.0	
M13	22.0	24.9	42.5		2.067		13.96	0.019	0.3	
Pipe: 24		0.0	74.0	M15			13.96	120	0.5	
M13	22.0	24.9	-16.3	M5	2.000	----	0.00		0.0	
M14	22.0	24.5	57.7		2.067		13.96	0.034	0.5	
Pipe: 25		0.0	92.0	M100			14.29	120	0.8	
M14	22.0	24.5	-18.0	M6	2.000	----	0.00		0.0	
M15	22.0	23.7	74.0		2.067		14.29	0.054	0.8	
Pipe: 26		0.0	290.8	M101			10.42	120	0.5	
M16	22.0	24.1	-92.0	M15	3.000	----	0.00		0.0	
M100	22.0	23.6	198.8		3.068		10.42	0.049	0.5	
Pipe: 27		0.0	198.8	M100			6.08	120	0.5	
M17	22.0	24.6	-18.2	M7	3.000	E: 7.0	7.00		0.0	
M16	22.0	24.1	180.6		3.068		13.08	0.041	0.5	
Pipe: 28		0.0	14.0	M1			14.29	120	0.1	
M3	22.0	29.4	14.1	B23	2.500	----	0.00		0.0	
M2	22.0	29.4	28.1		2.469		14.29	0.004	0.1	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 29		0.0	14.5	M12			13.96	120	0.1	
M4	22.0	29.6	28.1	M2	2.500	----	0.00		0.0	
M3	22.0	29.4	42.5		2.469		13.96	0.008	0.1	
Pipe: 30		0.0	15.1	M13			13.96	120	0.2	
M5	22.0	29.8	42.5	M3	2.500	----	0.00		0.0	
M4	22.0	29.6	57.7		2.469		13.96	0.014	0.2	
Pipe: 31		0.0	16.3	M14			14.29	120	0.3	
M6	22.0	30.1	57.7	M4	2.500	----	0.00		0.0	
M5	22.0	29.8	74.0		2.469		14.29	0.023	0.3	
Pipe: 32		0.0	18.0	M15			14.29	120	0.5	
M7	22.0	30.6	74.0	M5	2.500	----	0.00		0.0	
M6	22.0	30.1	92.0		2.469		14.29	0.034	0.5	
Pipe: 33		0.0	18.2	M16			6.08	120	0.6	
M8	22.0	31.1	92.0	M6	2.500	E: 6.0	6.00		0.0	
M7	22.0	30.6	110.2		2.469		12.08	0.047	0.6	
Pipe: 34		0.0	42.5	M13			207.92	120	4.2	
M3	22.0	29.4	-28.1	M11	1.250	2E: 6.0	18.00		0.0	
M12	22.0	25.2	14.5		1.380	2T:12.0	225.92	0.019	4.2	
Pipe: 35		0.0	57.7	M14			207.92	120	4.6	
M4	22.0	29.6	-42.5	M12	1.250	2E: 6.0	18.00		0.0	
M13	22.0	24.9	15.1		1.380	2T:12.0	225.92	0.020	4.6	
Pipe: 36		0.0	74.0	M15			207.92	120	5.3	
M5	22.0	29.8	-57.7	M13	1.250	2E: 6.0	18.00		0.0	
M14	22.0	24.5	16.3		1.380	2T:12.0	225.92	0.023	5.3	
Pipe: 37		0.0	92.0	M100			207.92	120	6.4	
M6	22.0	30.1	-74.0	M14	1.250	2E: 6.0	18.00		0.0	
M15	22.0	23.7	18.0		1.380	2T:12.0	225.92	0.028	6.4	
Pipe: 38		0.0	198.8	M100			207.92	120	6.5	
M7	22.0	30.6	-180.6	M17	1.250	2E: 6.0	18.00		0.0	
M16	22.0	24.1	18.2		1.380	2T:12.0	225.92	0.029	6.5	
Pipe: 40		0.0	0.0				22.58	120	1.6	
M9	22.0	32.8	110.2	M7	2.500	T:12.0	12.00		0.0	
M8	22.0	31.1	110.2		2.469		34.58	0.047	1.6	
Pipe: 41		0.0	180.6	M17			213.42	120	6.4	
TOR	22.0	39.2	110.2	M8	4.000	3E:30.0	30.00		0.0	
M9	22.0	32.8	290.8		4.026		243.42	0.026	6.4	
Pipe: 42		0.0	0.0			2ETCB	22.00	120	11.2	
BOR	2.0	50.4	290.8	M9	4.000		74.00		-8.7	
TOR	22.0	39.2	290.8		4.026		96.00	0.026	2.5	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 44		0.0	91.8	B116			19.96	120	0.3	
M100	22.0	23.6	199.0	M102	3.000	2E:14.0	29.00		4.5	
M101	11.5	23.3	290.8		3.068	T:15.0	48.96	0.099	4.8	
Pipe: 45		0.0	100.0	B115			11.17	120	1.6	
M101	11.5	23.3	99.0	M103	2.500	----	0.00		0.0	
M102	11.5	21.7	199.0		2.469		11.17	0.141	1.6	
Pipe: 46		0.0	0.0				11.17	120	0.4	
M102	11.5	21.7	99.0	B114	2.500	----	0.00		0.0	
M103	11.5	21.3	99.0		2.469		11.17	0.039	0.4	
Pipe: 47		0.0	0.0				2.50	120	1.4	
M101	11.5	23.3	91.8	S114	2.000	E: 5.0	15.00		0.0	
B116	11.5	21.9	91.8		2.067	T:10.0	17.50	0.080	1.4	
Pipe: 47A		5.60	24.4	Disch			10.50	120	3.0	
B116	11.5	21.9	67.4	S111	1.500	----	0.00		-0.1	
S114	11.8	18.9	91.8		1.610		10.50	0.271	2.8	
Pipe: 47B		5.60	23.3	Disch			10.50	120	1.6	
S114	11.8	18.9	44.2	S110	1.500	----	0.00		0.0	
S111	11.8	17.3	67.4		1.610		10.50	0.153	1.6	
Pipe: 48		0.0	0.0				2.50	120	1.6	
M102	11.5	21.7	100.0	S113	2.000	E: 5.0	15.00		0.0	
B115	11.5	20.0	100.0		2.067	T:10.0	17.50	0.094	1.6	
Pipe: 48A		5.60	22.8	Disch			10.50	120	3.4	
B115	11.5	20.0	77.2	S107	1.500	----	0.00		-0.1	
S113	11.8	16.6	100.0		1.610		10.50	0.317	3.3	
Pipe: 48B		5.60	21.4	Disch			10.50	120	2.1	
S113	11.8	16.6	55.8	S106	1.500	----	0.00		0.0	
S107	11.8	14.5	77.2		1.610		10.50	0.196	2.1	
Pipe: 49		0.0	0.0				2.50	120	1.6	
M103	11.5	21.3	99.0	S112	2.000	E: 5.0	15.00		0.0	
B114	11.5	19.6	99.0		2.067	T:10.0	17.50	0.092	1.6	
Pipe: 49A		5.60	22.6	Disch			10.50	120	3.4	
B114	11.5	19.6	76.4	S103	1.500	----	0.00		-0.1	
S112	11.8	16.3	99.0		1.610		10.50	0.311	3.3	
Pipe: 49B		5.60	21.1	Disch			10.50	120	2.0	
S112	11.8	16.3	55.2	S102	1.500	----	0.00		0.0	
S103	11.8	14.2	76.4		1.610		10.50	0.193	2.0	
Pipe: 50		5.60	22.2	Disch			10.50	120	1.6	
S111	11.8	17.3	21.9	S109	1.250	----	0.00		0.0	
S110	11.8	15.8	44.2		1.380		10.50	0.148	1.6	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 51		5.60	19.5	Disch			10.50	120	2.4	
S107	11.8	14.5	36.3	S105	1.250	----	0.00		0.0	
S106	11.8	12.1	55.8		1.380		10.50	0.229	2.4	
Pipe: 52		5.60	19.3	Disch			10.50	120	2.4	
S103	11.8	14.2	35.9	S101	1.250	----	0.00		0.0	
S102	11.8	11.9	55.2		1.380		10.50	0.224	2.4	
Pipe: 53		5.60	21.9	Disch			10.50	120	0.4	
S110	11.8	15.8	0.0		1.250	----	0.00		0.0	
S109	11.8	15.3	21.9		1.380		10.50	0.041	0.4	
Pipe: 54		5.60	18.6	Disch			10.50	120	1.1	
S106	11.8	12.1	17.7	S104	1.250	----	0.00		0.0	
S105	11.8	11.1	36.3		1.380		10.50	0.103	1.1	
Pipe: 55		5.60	18.4	Disch			10.50	120	1.1	
S102	11.8	11.9	17.5	S100	1.250	----	0.00		0.0	
S101	11.8	10.8	35.9		1.380		10.50	0.101	1.1	
Pipe: 56		0.0	0.0				10.50	120	0.0	
S108	11.8	15.3	0.0		1.000	----	0.00		0.0	
S109	11.8	15.3	0.0		1.049		10.50	0.000	0.0	
Pipe: 57		5.60	17.7	Disch			10.50	120	1.1	
S105	11.8	11.1	0.0		1.000	----	0.00		0.0	
S104	11.8	10.0	17.7		1.049		10.50	0.104	1.1	
Pipe: 58		5.60	17.5	Disch			10.50	120	1.1	
S101	11.8	10.8	0.0		1.000	----	0.00		0.0	
S100	11.8	9.8	17.5		1.049		10.50	0.102	1.1	
Pipe: 59		0.0	0.0				184.33	120	8.2	
M9	22.0	32.8	180.6	M16	3.000	T:15.0	15.00		0.0	
M17	22.0	24.6	180.6		3.068		199.33	0.041	8.2	
Pipe: 60		0.0	290.8	M101			3.83	120	0.1	
M15	22.0	23.7	-198.8	M16	2.500	----	0.00		0.0	
M100	22.0	23.6	92.0		2.469		3.83	0.034	0.1	
Pipe: 60A			0.0	Fixed Pressure Loss Device						
DCVA	2.0	55.4	290.8	TOR	5.0 psi, 290.8 gpm					
BOR	2.0	50.4	290.8							
Pipe: 61		0.0	0.0			2E:34.0	50.00	140	5.4	
UNDG1	-6.0	60.7	290.8	BOR	D4.000	T:34.0	71.00		-3.5	
DCVA	2.0	55.4	290.8		4.220	G: 3.0	121.00	0.016	1.9	
Pipe: 62		0.0	0.0				100.00	150	0.1	
UNDG2	-6.0	60.8	290.8	DCVA	8.000	G: 7.0	7.02		0.0	
UNDG1	-6.0	60.7	290.8		8.230		107.02	0.001	0.1	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 63		0.0	0.0			E:31.6	215.00	150	0.2	
UNDG3	-6.0	61.0	290.8	UNDG1	8.000	T:61.4	100.03		0.0	
UNDG2	-6.0	60.8	290.8		8.230	G: 7.0	315.03	0.001	0.2	
Pipe: 64		Source	0.0			E:27.0	90.00	150	2.5	
SOURCE	0.0	58.5	290.8	UNDG2	8.000	2T106.0	139.00		2.6	
UNDG3	-6.0	61.0	290.8		7.980	G: 6.0	229.00	0.001	0.1	

NOTES (HASS):

(1) Calculations were performed by the HASS 8.4 computer program
under license no. 3801093320 granted by
HRS Systems, Inc.
208 Southside Square
Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average
imbalance at each node of 0.001 gpm and a maximum
imbalance at any node of 0.066 gpm.

(3) Total pressure at each node is used in balancing the system.
Maximum water velocity is 15.8 ft/sec at pipe 48A.

(4) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

(5) Available pressure at source node SOURCE under full flow conditions is
74.30 psi compared to the minimum required pressure of 20.00 psi.

(6) PIPE FITTINGS TABLE

Pipe Table Name: STANDARD.PIP

PAGE: * MATERIAL: S40 HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
8.230	20.91	40.65	15.10	52.26	13.94	4.65	36.00	36.00	40.65

SECTION 16720 – ADDRESSABLE FIRE ALARM SYSTEM

1.0 GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract and Agreement apply to this Section.

B. Project Manual

1.2 Summary

A. Drawings supplied with this specification shall be used as a reference for the requirement and location of system components. Work includes visiting the site to observe the existing conditions, and confirmation of the required quantities of devices and specific options for locations of the same.

B. At the time of bid, all exceptions taken to these Specifications, variances from these Specifications and all substitutions of equipment specified shall be listed in writing and forwarded to Hughes Associates, Inc. (Engineer) and the City of Warwick (Owner). Any such exceptions, variances, or substitutions, which were not listed at the time of bid shall not be approved or considered.

C. The Work includes all labor, materials, services, software, programming, tools, transportation, and temporary construction necessary to fabricate, install, program and test a fully operational and code compliant UL Listed addressable fire alarm system as defined in the Rhode Island Fire Safety Code (RIFSC) system in the Ice Rink (975 Sandy Lane) and Pool (955 Sandy Lane) buildings. Work includes installing a new Honeywell fire network adapter in each building, as shown on provided plans. Fire network adapter to be installed in location noted on Contract Documents. Work includes installing new CAT5e plenum cable from the existing network switch to the fire network adapter in each building. Twisted pair wire shall be run from fire alarm control unit to the fire network adapter in each building, per manufacturer's recommendations. The Contractor shall provide 24VDC power to newly installed fire network adapter. Included in the scope of work is programming of both the fire alarm control unit and the Honeywell Enterprise Building Integrator located off-site. Contractor shall include in the bid one (1) year of Honeywell Enterprise Building Integrator License Agreement for 250 points total (250 total for 955 and 975 Sandy Lane). Install new addressable control modules at existing radio Masterbox. Masterbox shall report general alarm (Masterbox Zone 1) and main waterflow switch activation (Masterbox Zone 2) for 975 Sandy Lane and only general alarm (Masterbox Zone 1) for 955 Sandy Lane. Include additional programming and wiring to report fully to the Warwick Fire Department upon general alarm or main waterflow condition.

D. The Work includes all labor, materials, services, tools, transportation, and temporary construction necessary to remove the existing building fire alarm system equipment in the manner and to the extent indicated herein upon final acceptance of the new fire alarm system.

E. The Work includes all fees and activities required to secure approvals for necessary State and Local permits.

F. The Work includes submitting detailed Shop Drawing Plans, Wiring Diagrams, Calculations and Product Data to the Engineer for review prior to submitting same to local officials (as required) for approval and permit.

G. The Work includes performing field quality control activities.

H. The Work includes documenting and submitting the results of integrity and functional testing.

I. The Work includes performing an overall system, full-day test of the System prior to the "Pre-Acceptance" test.

J. The Work includes performing an overall system "Pre-Acceptance" test(s) for the Owner's and Engineer's approval.

K. The Work includes performing an overall system "Final Acceptance" test(s) for Authority approval.

L. The Work includes submitting As-built Plans and closeout documentation to the Engineer for review prior to scheduling Owner demonstration training.

M. The Work includes training Owner's personnel on the operation of the system, required maintenance tasks and frequencies, and the locations of all equipment necessary to maintain and operate the fire alarm system.

1.3 Performance Requirements

A. 24 VDC closed-circuit, electrically supervised, addressable, automatic fire alarm system. The system shall include, but not be limited to:

1. Fire alarm control unit (FACU).

2. Fire alarm system power supplies.

3. Addressable double-action manual fire alarm boxes at all building exits as shown on the drawings.

4. Photoelectric, addressable analog automatic smoke detectors (in those environments suitable for proper smoke detector operation), as indicated in this section and where shown on the drawings.

    a. Immediate Vicinity of Fire Alarm Control Equipment: System type, analog, addressable, photoelectric smoke detectors with standard bases located in the immediate vicinity of all fire alarm control equipment including remote power supplies and remote amplifiers.

    b. Common Corridors, common rooms and stairwell landings, System type, analog, addressable, photoelectric smoke detectors with standard bases located in common corridors and within each stairwell at every floor level.

    c. Where an area is environmentally unstable such that a smoke detector could experience high levels of dust or temperature variations above 100° F or below 32° F

and the area in question is protected by an automatic sprinkler system, smoke detectors shall be omitted. If an automatic sprinkler does not protect the area, an addressable heat detector shall be installed.

5. Audible and visible notification appliances (horn/strobe, horn only, and strobe only notification appliances) in common spaces, common bathrooms, as shown on the drawings.

6. Addressable monitor modules and addressable control relay modules, as shown on the drawings and described in this specification.

7. Existing Radio Masterbox (SigCom Radio Masterbox #339 and 341) to notify the Warwick Fire Department, as shown on the drawings and described in this specification.

1.4 Order of Precedence

A. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply; however, should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:

1. State and local codes shall take precedence over this specification.

2. The National Fire Protection Association Standards shall take precedence over this specification.

3. This specification shall take precedence over the drawings.

1.5 Submittals

A. Pre-Installation Documentation:

1. Product Data: For each product specified in Part 2. Submittal shall indicate listing and approvals, selected options and electrical characteristics.

2. Equipment List: Identify type, quantity, make and model number of each piece of equipment (including spare components) included in submittal. Types and quantities of equipment indicated shall coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings.

3. Shop Drawing Plans: Corresponding riser diagram inclusive of information required by NFPA 72-2010 requirements.

4. Wiring Diagrams: Point-to-point fire alarm control equipment installation diagrams inclusive of information required by NFPA 72-2010 requirements.

5. Battery Calculations: Prepared in accordance with NFPA 72-2010 requirements and showing total standby power and total alarm power required to meet the specified system requirements. Include a complete list of current requirements during normal, supervisory, trouble, and alarm conditions for each component of the system.

6. NAC circuit loading calculations.

7. Voltage-drop Calculations: Prepared in accordance with NFPA 72-2010 requirements to demonstrate that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.

8. Sequence of Operation: A sequence of operation that describes how the system responds during an alarm, supervisory and trouble condition. The description shall include fire alarm control unit LEDs, audible and visible indications; initiating devices, notification appliances, and auxiliary functions. The description shall provide sufficient information so that the exact function of each installed device and appliance is known.

9. Statement of Equipment Lifecycle: A written statement, signed by a representative of the equipment manufacturer stating that the equipment to be supplied is not at or near the end of its life cycle and that replacement components for all control equipment shall be available from the manufacturer for a minimum of 15 years from the date of installation.

B. Pre-Programming Documentation:

1. Device Address List: Indicating proposed label verbiage for each address.

C. Pre-Acceptance Documentation:

1. As-Built Drawings: Showing all field changes from original Shop Drawing Plan submittal. Drawings shall include:

   a. The exact locations and installation details of all equipment installed including the FACU(s), remote power supplies, all initiating devices, monitor modules, control modules and fault isolator modules with the address of each addressed device and all notification appliances.

   b. The installed wiring and color-coding and wire tag notifications for the exact locations of all installed junction boxes and terminal cabinets.

   c. Specific point-to-point interconnections between all equipment and internal wiring of the equipment. Typical point-to-point wiring diagrams are not acceptable.

2. Preliminary test report indicating that all devices and appliances within the building have been tested in accordance with NFPA 72-2010 guidelines.

3. Preliminary Record of Completion: Prepared in accordance with NFPA 72-2010 §4.5.2.1(a).

4. Statement of Completion; to indicate that system installation, field quality control and commissioning is complete, a signed written statement, substantially in the form as follows:

   "The undersigned, having been engaged as the Fire Alarm Contractor for the fire alarm systems at 955 and 975 Sandy Lane for the Warwick Municipal Buildings Fire Alarm and Sprinkler Upgrade Project located in Warwick, Rhode Island, confirms that the fire alarm system equipment has been installed in accordance with the system manufacturer's wiring diagrams, installation instructions and technical specifications provided to us by the manufacturer and the City of Warwick. Field quality control procedures are complete, system indicators are normal, and the system is suitable for demonstration testing."

D. Final Acceptance Documentation:

1. As-Built Drawings: With final revisions per Engineer's comments.

2. Final Record of Completion: Prepared in accordance with NFPA 72-2010.

3. Test Reports: From Pre-Acceptance testing; substantially in the format and inclusive of information required by NFPA 72-2010 Figure 10.6.2.3.

E. Closeout Documentation:

1. Maintenance Data: Operating and Maintenance Manual to include the following:

a. Final Equipment List identifying the quantities and types of equipment listed by manufacturer's part number.

b. Detailed narrative description of the system inputs, evacuation signaling, ancillary functions, annunciation, sequence of operations, expansion capability, application considerations, and limitations.

c. Product datasheet (or specification sheet) for each piece of fire alarm system equipment installed.

d. Operator instructions for basic system operations, including alarm acknowledgement, system reset, interpretation of system output, operation of manual evacuation signaling and ancillary function controls.

e. Standby power calculations and voltage drop calculations that coincide with the equipment that has been installed in the building.

f. Point ID list referencing the signaling line circuit loops and the devices on those loops.

g. Sensitivity report for all smoke detectors at the time of acceptance.

h. Testing results of all wiring free from faults, as specified in this specification.

i. Detailed description of routine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including testing and maintenance instructions for each type of device installed.

1) This information shall include manuals that outline inspection, testing and cleaning procedures for all detectors and control equipment, as well as any other special maintenance procedures for any other pieces of fire alarm system equipment installed in the buildings.

j. Detailed troubleshooting instructions for each trouble condition generated from the monitored field wiring, including opens, grounds, and loop failures.

1) These instructions shall include a list of all trouble signals annunciated by the system, a description of the condition(s) that causes such trouble signals,

and step-by-step instructions describing how to isolate such problems and correct them (or how to call for service, as appropriate).

k. A service directory, including a list of names and telephone numbers of those who provide service for the system.

2. Documentation of programming with the disks containing the programming information. Include necessary non-disclosure agreement or licensing agreement.

3. Electronic As-Built Drawings: Submit electronic AutoCAD files on compact disk. Coordinate AutoCAD version with Owner at time of submittal.

4. Statement of Warranty.

1.6 Coordination

A. Coordinate the installation of the fire alarm system and testing of associated equipment and circuits with all related trades, contractors, equipment maintenance and testing representatives, the Engineer, the Owner and the authorities having jurisdiction.

B. Sprinkler waterflow switches and valve supervisory switches. Include wiring up to and including connection to all sprinkler waterflow switches and valve supervisory switches. All sprinkler waterflow and supervisory switches shall be monitored for integrity in accordance with NFPA 72. Verify the quantity and location of all sprinkler waterflow and supervisory switches.

C. Air Handling Units (AHU). The contractor shall coordinate the installation of duct smoke detectors, remote test switches and addressable control modules for automatic AHU shutdown with the HVAC Contractor. The Contractor shall coordinate with the HVAC contractor to verify AHU shutdown operations function successfully as specified in this specification.

D. Emergency Generator. The contractor shall coordinate the installation of addressable monitor modules for monitoring of the emergency generator. The Contractor shall coordinate the location with the automatic transfer switch.

1.7 Quality Assurance

A. Each component of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category for the intended use in Underwriters Laboratories, Inc. (UL), UL FPED *Fire Protection Equipment Directory*, 2010 Edition. All control equipment shall be listed under UL category UOJZ Control Units System as a single unit. Partial listings, or multiple listings for various major sections of the control equipment, shall not be acceptable.

B. If a UL listing for a specific device is unavailable, approval by FM Global (FM) or other nationally recognized testing laboratory (NRTL) acceptable to the Owner and the Engineer shall be acceptable.

C. Electrical components, devices, and accessories shall be Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. All control equipment shall have transient protection devices that comply with the requirements outlined in UL 864, *Standard for Control Units for Fire-Protective Signaling Systems.*

E. All materials and equipment (initiating devices, notification appliances, etc.) shall be new and unused.

F. All equipment supplied shall be first quality and the manufacturer's best type and latest model capable of complying with all requirements of this specification and shall have been in continuous production and in continuous service in commercial applications for at least one year. Obsolete equipment shall not be used.

G. Installer Qualifications:

1. Licensed in the State of Rhode Island and be experienced in the installation of fire alarm systems in buildings similar to the Work described herein and has obtained design and inspection approvals for similar projects from Authorities Having Jurisdiction (AHJ).

2. Foreman: Provide proof of competence of both their company and the individual foreman that will be assigned to this project, in the area of installing fire detection, alarm, and control systems for at least five (5) years and acceptable to the Owner. Once assigned, the Contractor's foreman shall not be changed without the approval of the Owner.

H. The fire alarm system shall comply with all applicable state and local codes including the Rhode Island Fire Safety Code.

I. Buildings accessible to the disabled or impaired shall comply with the provisions of the *Americans with Disabilities Act Accessibility Guidelines (ADAAG).*

J. Products, installation and testing shall be in accordance with the applicable provisions of the following:

1. NFPA 1, *Fire Code*, 2012 Edition, as amended.

2. NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2010 Edition.

3. NFPA 70, *National Electrical Code*, 2011 Edition.

4. NFPA 72, *National Fire Alarm Code*, 2010 Edition.

5. NFPA 101, *Life Safety Code*, 2012 Edition, as amended.

K. The requirements and recommendations of the latest published edition of the equipment manufacturers' product datasheets, technical specifications, installation instructions and wiring guidelines shall be followed.

1.8 Scheduling

A. The Contractor's Foreman shall act as primary point of contact and responsible-in-charge for coordinating the Pre-Acceptance Test with the other portions of the Work, Owner and the Engineer.

B. The Contractor's Foreman shall act as primary point of contact and responsible-in-charge for coordinating the Final-Acceptance Test with the other portions of the Work, Owner, Engineer and Authorities.

1.9 Warranty

A. The Contractor shall guarantee all new equipment installed and new raceways, new wiring and connections to existing wiring from defects in workmanship and inherent mechanical and electrical defects for a period of one (1) year from the date of substantial completion of the project. See Part 1 "Submittals".

B. The Manufacturer or the authorized representative shall guarantee all new system equipment for a period of two (2) years from the date of substantial completion of the project. See Part 1 "Submittals".

2.0 PRODUCTS

2.1 Manufacturers

A. Fire alarm system control equipment shall be manufactured by:

1. Honeywell XLS120

B. Distributors of acceptable manufacturer's equipment shall provide documentation indicating that they are authorized by the manufacturer to distribute and service the equipment and that the manufacturer has stated that they have satisfactorily completed all training courses offered by the manufacturer in relation to the equipment provided.

2.2 Functional Description of the System

A. The system shall include new control/communications equipment which is UL Listed to operate with the submitted manual fire alarm boxes and smoke detectors, and shall alert building occupants using audible and visible notification appliances, supervise each system for conditions which would impair proper system operation, annunciate such abnormal conditions, and where applicable, control related equipment as indicated on contract documents.

B. Alarm Condition

1. The system operation shall be such that the alarm operation of any alarm initiating device shall not prevent the subsequent alarm operation of any other initiating device due to wiring or power limitations.

2. The system alarm operation subsequent to the alarm activation of any manual fire alarm box, any system-type automatic detection device (smoke or heat detector), operation of a fixed suppression system or sprinkler waterflow switch shall automatically perform the functions contained in this section and operate as follows:

a. The evacuation signal (temporal code 3 National Evacuation Signal) and all visible notification appliances (flashing in synchronization) shall activate throughout the building. This shall be repeated until the system is reset.

1) All strobe notification appliances shall operate in synchronization in accordance with the requirements of NFPA 72.

b. The general alarm shall immediately be transmitted to the Warwick Fire Department via the existing radio masterbox.

3. Fire Alarm Control Unit Indication

a. Alarm conditions shall be immediately displayed on the control unit alphanumeric display, indicating all information associated with the fire alarm condition including type of device, its location and the time and date of activation. The red "ALARM" LED shall flash on the control unit until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another initiating device after acknowledgment shall flash the alarm LED on the control unit and the display shall show the new alarm information.

b. During an alarm condition, a pulsing alarm tone shall sound within the control until the alarm is acknowledged.

c. If the audible alarm signals are silenced for any reason, they shall automatically resound if another initiating device is actuated.

d. When the alarm signals are silenced by pressing the "ACKNOWLEDGE" pushbutton on the control module, the control unit LED's shall continue to flash until the alarm is reset at the control unit.

e. The alarm sequence shall be recorded with the time and date of all occurrences in the fire alarm system History Log.

4. Auxiliary Functions

a. Where applicable, all auxiliary functions shall be connected to and operated by the control unit.

b. Automatic AHU shutdown. All AHU units greater than 2000cfm shall automatically shut down upon general alarm.

c. Magnetic door holder release. Upon receipt of an alarm from any initiating device or loss of power, magnetic door hold-open devices (as shown on the drawings) shall release, allowing the held open door to automatically close.

C. Supervisory Condition

1. The control unit shall have a "SYSTEM SUPERVISORY" LED and a supervisory signal "ACKNOWLEDGE" switch.

2. When a supervisory condition is detected, the following functions shall immediately occur:

    a. The "SYSTEM SUPERVISORY" LED shall flash.

    b. A pulsing alarm tone in the control unit shall sound.

    c. The display shall indicate all information associated with the supervisory condition, including device, its location within the protected premises, and the time and date of that activation.

    d. If more supervisory signals are in the system, the operator shall be able to scroll the display to view new signals.

    e. All system output programs assigned via control-by-event equations to be activated by the particular point monitored shall be executed, and the associated system outputs (Supervisory Notification Appliances and/or relays) shall be activated.

3. Unacknowledged alarm messages shall have priority over supervisory messages, and if an Alarm occurs during a supervisory sequence, the Alarm condition shall have display priority.

4. Activating the supervisory "ACKNOWLEDGE" switch shall silence the audible signal while maintaining an LED on, indicating the supervisory condition is still in the off-normal state.

5. Restoring the valve or supervisory contact to the normal position shall cause the supervisory service audible signal to pulse thus indicating restoration to normal position. Activating the "ACKNOWLEDGE" switch shall silence the audible signal and restore the system to normal.

6. The following shall activate an audible supervisory signal and illuminate the supervisory LED at the control unit.

    a. Activation of any sprinkler valve tamper switch.

    b. Fire pump running, power failure, or phase reversal.

    c. Generator running.

D. Trouble Condition

1. When a trouble condition is detected, the following functions shall immediately occur:

    a. An amber "SYSTEM TROUBLE" LED shall light and the system audible signal shall steadily sound when any trouble is detected in the system. Failure of normal power, opens or short circuits on the signaling line circuits or the notification appliance circuits, disarrangements in system wiring, failure of the microprocessor or any identification module, or system ground faults shall activate this trouble circuit.

b. A trouble signal may be acknowledged by actuating the "ACKNOWLEDGE" switch. This shall silence the control unit trouble buzzer. If additional trouble conditions occur, the trouble circuitry shall resound.

c. During an "alarm" condition, all "trouble" signals shall be suppressed with the exception of lighting the amber "COMMON TROUBLE" LED steadily.

d. The display shall indicate all information associated with the trouble condition, including type of trouble point, its location within the protected premises, and the time and date of that activation.

e. All system output programs assigned via control-by-event equations to be activated by the particular point in trouble shall be executed, and the associated System Outputs (Trouble Notification Appliances and/or relays) shall be activated.

2. Unacknowledged alarm messages shall have priority over trouble messages, and if such an Alarm occurs during a Trouble sequence, the Alarm condition shall have display priority.

E. System Supervision

1. All wiring extending from the FACU enclosure to fire alarm system components shall be supervised for opens, shorts and grounds. Systems containing unsupervised wiring of any type shall not be acceptable.

2. The occurrence of any fault shall activate the system trouble circuitry, but shall not interfere with the proper operation of any circuit that does not have a fault condition.

3. Incoming 120 VAC line power shall be supervised so that any power failure shall be audibly and visually indicated at the control unit.

4. Batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control unit.

F. System Reset

1. A "SYSTEM RESET" button shall be used to return the system to its normal state after an alarm condition has been remedied. Printed messages shall provide operator assurance of the sequential steps (i.e.: "IN PROGRESS", "RESET COMPLETED") as they occur, should all alarm conditions be cleared.

2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The control unit "ALARM" LED shall remain on. These points shall not require acknowledgment if they were previously acknowledged.

2.3 Minimum Components

A. The automatic fire detection and alarm system shall consist of, but not be limited to:

1. Fire alarm control unit (FACU).

2. Input Devices (waterflow switches and valve supervisory switches).

3. Addressable, analog photoelectric smoke detectors, with standard bases.

4. Addressable double-action manual fire alarm boxes.

5. Addressable monitor modules and control relay output modules.

6. Fault Isolator Modules.

7. Annunciation at the FACU and remote LCD annunciators, as shown on the drawings.

8. A permanent record of the alarm signal, time, and date.

9. Audible and visible notification appliances.

10. Battery backup supervision.

11. Automatic supervision of alarm initiating circuits and notification appliance circuits.

12. Transmission of alarm signals to the Warwick Fire Department.

13. Existing radio masterbox.

14. Protective guards for notification appliances as indicated by Contract Documents

15. Stopper II covers for fire alarm boxes as indicated by Contract Documents

2.4 Fire Alarm Control Unit (FACU)

A. The FACU shall provide power, English display status, supervision, control, and programming capability for the fire detection and alarm system.

B. The control unit shall be in a location approved by the Engineer, the Owner and the AHJ as shown on the drawings.

C. The control unit shall store a record of alarm and trouble events in a nonvolatile history file. This file shall contain, at least, the most recent 500 events, with time and date of each event. It shall be possible to select the number of events to be viewed in the history file so that the entire file does not have to be downloaded. The history file shall remain intact in the event of a loss of AC and battery power.

D. The control unit shall contain a minimum of one (1) signaling line circuits. Each signaling line circuit shall support a minimum of 100 addressable input devices or addressable monitor modules and a minimum of 10 output devices. All addressable input and output devices shall be capable of being intermixed on the same signaling line circuit.

E. A minimum of two (2) signaling line circuits shall be used within each building with devices equally distributed on each circuit. Each signaling line circuit shall be loaded to no more than

75% of its manufacturer specified capacity. Additional SLCs shall be furnished and installed as necessary to comply with this requirement.

F. A minimum of three fault isolator modules shall be used on each signaling line circuit. One fault isolator module shall be installed at the point the SLC leaves the FACU and at the point where new installed Class A SLCs return to the FACU. Fault isolator modules shall be placed in order to minimize loss of addressable devices. Fault isolator modules shall be placed at each floor, where the SLC spans multiple floors. No more than 25 devices shall be installed on a circuit between fault isolators.

G. The fire alarm system shall provide a minimum of one (1) visible (strobe) notification appliance circuit (NAC). Visible (strobe) notification appliance circuits shall be independent from the audible notification appliance circuits. Each circuit's power load shall not exceed 75% of the individual circuit power available from the FACU and new installed circuits shall be Class A circuits. Additional NACs shall be furnished and installed as necessary to comply with this requirement.

H. Power for all notification appliances shall come from integral power supplies in the control unit. Remote power supplies shall be provided as needed and shall be of the same manufacturer as the FACU. All locations containing remote control equipment (such as a power supply extender) shall be protected with a smoke detector, in accordance with NFPA 72.

I. The functional operation of the control unit shall be established by programmable software.

1. The operating program shall be contained in nonvolatile EEPROM memory and shall be configurable in any of the following ways:

   a. At the factory;

   b. At the job site via modem; or

   c. At the job site via standard terminal or standard laptop computer.

J. Access and control of the operating program shall be restricted to proper personnel designated by the Owner

1. The control unit shall have a minimum of three (3) security levels, and they shall be designated: "ELECTRICIAN", "ALARM SYSTEM SERVICE TECHNICIAN", and "MANUFACTURER." Each level shall have individual passwords. Illegal access attempts shall be rejected by the system and shall be displayed and recorded in the history file with time and date.

2. The "ELECTRICIAN" security level shall be the lowest security level and shall only allow access to the system status levels and lists and shall not impair system operation.

3. The "MANUFACTURER" and "ALARM SYSTEM SERVICE TECHNICIAN" security levels shall allow access to the operating system.

4. Accessing a programming function that disables normal system operation shall initiate a trouble sequence.

K. The fire alarm control unit, all remote annunciators, and remote power supplies shall contain an integral standby battery to provide continuous power in the event of AC power failure.

1. The batteries shall be capable of providing 60 hours of backup power for the system and enough remaining power to operate all notification appliances for 5 minutes at the end of the 60 hour period.

2. The calculations for battery standby shall include a "safety factor" (reserve power estimate) of a minimum 15%.

3. Transfer from AC to battery power shall be instantaneous when AC voltage drops below 85 percent input. Transfer to battery standby shall be indicated by display and recorded in the history file with time and date. The indication shall be "AC OFF".

4. Loss of building power for the system shall automatically and immediately cause transfer of the system to battery power and cause all audible trouble signals to sound. Upon return of building power, the system shall automatically retransfer thereto, and the batteries shall automatically recharge.

5. During battery operation, the control unit shall process all inputs. However, the display shall provide five (5) seconds of indication for each new input condition, then turn off to conserve battery power.

6. The control unit shall have a dual rate battery charger that shall maintain the batteries in a fully charged condition and shall provide recharge of the batteries to full capacity in forty-eight (48) hours.

L. The control unit shall provide a nonprogrammable DPDT common alarm relay and common trouble relay both with contacts rated 2 AMP at 24 VDC.

M. Output Function Modules. The control unit shall utilize output function modules to control output functions. The modules shall plug into the control unit motherboard. The functions and presence of each module shall be supervised, and "ELECTRICIAN" password shall enable the user to request a list that locates the module by panel and slot within system. All modules shall be individually programmable by circuit as hereinafter specified.

1. Addressable control relays shall be provided for each of the auxiliary functions; field verify quantities and locations.

2.5 Wiring

A. Wiring for the initiating devices, notification appliances and remote 80 character LCD display shall be solid or stranded copper and shall comply with the appropriate sections of the *National Electrical Code* and the RILSC. All system wiring size shall be as determined suitable by the manufacturer and in compliance with the *National Electrical Code*, yet they shall not be any smaller than 16AWG.

B. Shielded wire shall be used only as directed by the FACU manufacturer.

C. All wiring shall be installed in metal raceway.

D. The minimum separation between the outgoing and return circuits shall be a minimum of 1-foot vertically and 4-foot horizontally where practical.

E. Twisted pair shall be used as directed by the FACU manufacturer.

F. MC cable shall only be installed where wiring is concealed.

2.6 System Field Devices - General

A. Addressable devices shall operate under the following ranges of environmental conditions:

1. Ambient Temperature: 32-100 degrees Fahrenheit.

2. Relative humidity: 0-93 percent, non-condensing.

3. Air velocity: 300 feet per minute.

B. Each addressable device shall include a means to assign a unique address code to the device in the field. This address code shall serve as the means by which the system program recognizes the device.

C. Failure of any single device shall not hinder the operation of any other devices connected to the signaling line circuit.

D. Failure of the control unit to properly communicate with any addressable device shall initiate the proper trouble sequence. While in this trouble condition, the control unit shall cause actual alarm input from devices to override trouble alarm.

2.7 Automatic Detectors – General

A. All automatic smoke detectors shall be of the addressable, analog photoelectric type and shall be interchangeably mounted into a common twist-lock base.

B. The control unit shall recognize changes of detector type in each location and provide proper indication that reprogramming for the affected address is required.

2.8 Addressable Photoelectric Smoke Detectors

A. Addressable analog photoelectric smoke detectors with standard base shall be installed in all common corridors and in the vicinity of all fire alarm system control equipment, in accordance with this specification and as shown on the drawings. Unless otherwise shown on the drawings, these common area detectors shall be spaced at thirty (30) foot centers, and spaced in accordance with NFPA 72 and the manufacturer's installation instructions. Smoke detectors shall only be installed in those environments suitable for proper smoke detector operation.

B. UL 268, photoelectric smoke detector with general alarm setting in all common spaces of 3.0% - 4.0% per foot obscuration.

C. The detectors shall provide a combination alarm/power LED. The LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control unit. The LED shall be placed into steady illumination under an alarm condition. An output connection shall also be provided in the base to connect an external remote alarm LED. The mounting location of every device shall be approved by the Owner.

D. Addressable Photoelectric Smoke Detectors shall be Honeywell Model TC806B Photo Detector. Duct Detector housing shall be Honeywell Model DNR Duct Detector.

2.9 Detector Bases

A. Automatic detectors shall utilize a common, plug-in, twist-lock, tamper-resistant type base that accommodates photoelectric and thermal detectors. Detectors shall be interchangeable to simplify field conversion.

B. Provide bases constructed of white, high impact polycarbonate designed for mounting on a standard 3-1/2 inch or 4 inch octagonal or 4-inch square outlet box. Provide screw terminal connections for No. 14 AWG wire.

C. Removal of the detector from the base shall cause a trouble indication at the FACU. Removal of the detector shall not disrupt the alarm circuit wiring or prevent the receipt of alarms from other devices operating in the circuit.

D. Insertion of an incorrect detector type into the base shall cause a "Wrong Device" trouble condition at the FACU until the proper type of detector is installed, or the system is reprogrammed. The system program shall recognize the insertion of a wrong device and shall automatically default to the setpoint values corresponding to the inserted device, and shall monitor alarm and trouble conditions according to the default parameters.

2.10 Addressable Manual Fire Alarm Boxes

A. Manual fire alarm boxes shall be UL 38 non-coded, double-action type, surface or semi-flush mounted, with integral contact monitor module to provide addressable operation.

B. Faceplates shall be red with raised white identification lettering.

C. Stations shall mechanically latch after operation, with a key operated reset feature, keyed the same as FACU.

D. Addressable Manual Fire Alarm Boxes shall be Honeywell Model S464G.

E. Stopper II protective guards shall be provided on fire alarm boxes in 975 Sandy Lane in all areas of the First Floor except the Mechanical/Refrigerant Room, as indicated on the Contract Documents.

2.11 Remote Fire Alarm Test Stations

A. Remote fire alarm test stations shall be installed to test fire alarm devices including but not limited to line-type heat detection, beam smoke detectors and duct smoke detectors.

2.12 Addressable Monitor Modules

A. Each addressable monitor module shall be able to support any number of normally open (N/O) devices. Wiring to the devices(s) being monitored shall be Class A supervised. Module status (normal, alarm, supervisory, trouble) shall be transmitted to the FACU.

B. Addressable monitor modules shall include a mounting plate for installation in a junction box or shall be mounted in a locked cabinet or approved box, as shown on the manufacturers recommended specifications.

C. The addressable monitor modules shall provide address-setting means.

D. An LED shall be provided which shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control unit.

E. In areas with multiple monitor modules, they shall be installed in monitor module cabinets approved by HAI and the Owner.

F. Addressable Monitor Modules shall be Honeywell Model TC809A.

2.13 Addressable Control Relay Output Modules

A. Provide addressable control relay output modules to permit hardwired control capability from the signaling line circuit. Relay contacts shall be DPDT, rated 2 amperes at 24 VDC.

B. Each relay shall operate according to the control program resident in the FACU. Relays shall be supervised for trouble conditions (open, short, device missing/failed) at the FACU.

C. Relay output modules shall include a mounting plate for installation in a junction box.

D. The relay output module shall provide address-setting means and shall also store an internal identifying code which the control unit shall use to identify the type of device.

E. An LED shall be provided which shall flash under normal conditions, indicating that the Relay Output Module is operational and is in regular communication with the control unit.

F. Provide transient suppressors for inductive loads.

2.14 Fault Isolator Modules

A. Fault isolator modules shall provide short circuit isolation for signaling line circuit wiring. Fault isolator modules shall be listed to UL 864, *Standard for Control Units for Fire-Protective Signaling Systems*.

B. The isolator module shall mount directly to a minimum 2 1/8 inch deep, standard 4-inch square electrical box, without the use of special adapters or trim rings.

C. Power and communications shall be supplied by the signaling line circuit.

D. Fault isolator modules shall report faults to the master FACU.

E. After the wiring fault is repaired, the fault isolator modules shall test the lines and automatically restore the connection.

2.15 Notification Appliance Remote Power Supplies

A. General

1. Remote power supplies shall power and supervise a minimum of 2 Class A NACs that shall be capable of being synchronized together on the same circuit, being synchronized together with notification appliance circuits on other power supplies, and being synchronized with notification appliance circuits connected directly to the FACU.
2. Remote power supplies shall have an auxiliary power output for providing remote power to fire alarm system devices other than notification appliances. Devices to be powered from auxiliary power output shall be approved by the Manufacturer and have been tested by a UL and/or FM.
3. Remote power supplies shall be connected to FACU, supervised by and activated by a dedicated Class A notification appliance circuit.
4. Remote power supplies shall be supervised for loss of power, brownout, and battery trouble conditions. NACs shall be supervised for wiring faults including, opens, wire-to-wire short circuits and earth faults. Remote power supply Trouble signal(s) shall report on the FACU display. Additionally, remote power supply shall have visible indicators (LEDs) for displaying Trouble signal(s) and indicating which NAC is in Trouble at the power supply.
5. All locations containing remote control equipment (such as a power supply extender) shall be protected with a smoke detector, in accordance with NFPA 72 – 2010.

B. Manufacturers

1. Honeywell ACPS-610 Addressable Charger Power Supply.

2.16 Audible and Visible Notification Appliances

A. General

1. All notification appliances shall be rated at 24 VDC and shall be powered by supervised notification appliance circuits originating from the FACU and remote power supplies.

2. The notification appliances shall be installed in accordance with the required audibility levels and the required illumination levels as described in NFPA 72.

3. All notification appliances shall be installed in environmental conditions in accordance with their listing and manufacturer's specifications and installation instructions. Where required, notification appliances that are to be installed in outdoor areas or in areas with harsh environmental conditions shall be tested and listed for outdoor use or for weatherproof applications.

4. Horn notification appliances shall be Honeywell Model HR.

5. Horn/Strobe notification appliances shall be Honeywell Model P2RH.

6. Strobe notification appliances shall be Honeywell Model SCW.

7. Notification appliances shall be provided protective cover in areas open to the ice rink and locker rooms, as indicated on the Contract Documents.

B. Audible (horn) notification appliances

1. Fire alarm horns shall be listed in accordance with UL 464, *Standard for Audible Signaling Appliances.*

2. The horn, whether integral with a combination horn/strobe unit or a separate appliance, shall have a minimum output designation from UL of 90 peak dBA at 10 feet or 15 dBA above the average ambient sound level, whichever is louder.

C. Visible (strobe) notification appliances

1. All strobes shall conform to the requirements of NFPA 72, UFAS and the ADA and shall be listed to UL 1971, *Standard for Signaling Devices for the Hearing Impaired*.

2. All visible notification appliance circuits shall be synchronized and have a rated light output as indicated on design drawings.

2.17 Transmission of Signals

A. All alarm signals shall be transmitted to the Warwick Fire Department via the existing radio masterbox.

B. Addressable control modules shall be installed to activate each radio Masterbox zone.

C. Masterbox shall report “General Alarm” on Masterbox Zone 1 (955 and 975 Sandy Lane).

D. Masterbox shall report “Main Waterflow Switch Activation” on Masterbox Zone 2 (975 Sandy Lane only).

2.18 Fire Network Adapter

A. Install Fire Network Adapter in each building as indicated on Contract Documents.

B. Fire Network Adapter shall be Honeywell Model FNA-3 fire network adapter.

C. Install Cat-5e plenum cable from network switch to Fire Network Adapter.

D. Install twisted pair wire from Fire Alarm Control Unit to Fire Network Adapter, per manufacturer’s requirements.

E. Install 24VDC power to supply Fire Network Adapter, per manufacturer’s requirements.

3.0 EXECUTION

3.1 Examination

A. Coordinate examinations with the Owner.

B. Examine and verify actual location of equipment, initiating devices, notification appliances, monitor modules, output modules, fault isolation modules, remote power supplies and other components.

C. Examine and verify actual locations of vertical and horizontal raceway including existing raceway that may be reused.

D. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing and other conditions where equipment is to be installed prior to preparing pre-installation submittal.

E. Promptly report conflicts with proposed solutions.

3.2 Preparation

A. Prepare and submit a minimum of six (6) complete "Pre-Installation Documentation" submittal packages to the Engineer for review prior to submitting same to local officials (as required) for approval and permit. Resubmit portions or entirety of submittal to address Engineer comments prior to submitting package to local officials (as required) for approval and permit. See Part 1 "Submittals" for submittal content.

B. Obtain Owner approval to deliver materials and begin installation once "Pre-Installation Documentation" review process is complete and necessary local approvals and permits have been secured.

3.3 General Equipment Installation

A. Installation, workmanship, fabrication, assembly, erection, examination, inspection and testing shall be in accordance with NFPA 72.

3.4 Initiating Device Installation

A. In general, automatic detectors shall be mounted on the structural ceiling, finished ceiling, or finished wall; as shown on the drawing. Automatic detectors shall be installed as indicated on the plans and in conformance with all codes and Regulations and these specifications. The detectors shall be installed within five (5) feet of the location shown on the drawings to accommodate construction.

B. Automatic detectors shall be located near points where air currents normally intersect. Detectors shall not be located in the direct path of the draft from an HVAC air supply grille, a door, window, or hallway. Detectors shall be installed a minimum of three (3) feet from an HVAC air supply diffuser, in accordance with NFPA 72.

C. Addressable analog photoelectric smoke detectors shall be installed in all common corridors in accordance with this specification, and as shown on the drawings. Unless otherwise shown on the drawings, these common corridor detectors shall be spaced at thirty (30) foot centers, and in accordance with NFPA 72 and the manufacturer's installation instructions. Smoke detectors shall only be installed in those environments suitable for proper smoke detector operation.

D. Addressable heat detectors shall be installed in environments appropriate for proper detection in accordance with NFPA 72 and the manufacturer's installation instructions.

E. In unsprinklered areas where the environment is not suitable for proper operation of addressable heat detectors, conventional spot-type heat detectors shall be furnished and installed. Conventional heat detectors shall be monitored and supervised by addressable monitor modules. Addressable monitor modules shall be installed in an area where the environmental conditions are suitable and the monitor modules' initiating circuits extended to the conventional heat detectors alarm contacts.

F. Manual fire alarm boxes shall be installed at every exit and in common areas in accordance with NFPA 72, as shown on the drawings.
   1. Stopper II protective guards shall be provided on fire alarm boxes in 975 Sandy Lane in all areas of the First Floor except the Mechanical/Refrigerant Room, as indicated on the Contract Documents.

G. Manual fire alarm boxes shall be mounted at a maximum height of 48 inches measured to the activating handle, above the finished floor, in accordance with NFPA 72 and the ADA Guidelines.

3.5 Notification Appliance Installation

A. All wall-mounted visible notification appliances shall be mounted such that that the entire strobe lens is not less than eighty (80) inches and not greater than ninety-six (96) inches above the finished floor, or six (6) inches below the finished ceiling, whichever is lower.

B. All visible notification appliances shall be synchronized.

C. Notification appliances shall be provided protective cover in areas open to the ice rink and locker rooms, as indicated on the Contract Documents.

3.6 Wiring Installation

A. The wiring and raceway system for the fire alarm system shall be in accordance with NFPA 70, *National Electrical Code*. Device and appliance boxes shall be new and low-profile.

B. Furnish metal raceway, wiring, outlet boxes, junction boxes, cabinets, labels and similar devices necessary for the complete installation of the fire alarm system. Wiring shall be of the type as specified herein and recommended by the manufacturer and shall be installed in metal raceway throughout.

C. Fire alarm system wiring within the building shall be installed in EMT or MC cable. MC cable shall only be installed where concealed above acoustic ceiling tile.

D. All wiring shall be installed continuous from device to device.

E. Terminal cabinets with hinged, lockable red covers, by Space Age Electronics, Marlboro, MA, or approved equal shall be provided at all junction points. All conductor splices shall be made on screw-type terminal blocks – wire nuts, butt, crimp or screw type connectors shall not be used. All terminals within a terminal cabinet shall be properly and permanently labeled. All junction box covers shall be painted red.

F. Raceways containing conductors identified as "Fire Alarm System" conductors shall not contain other conductors, and no AC carrying conductors shall be allowed in the same raceway with the DC fire alarm detection and signaling conductors.

G. The conductors for the notification appliance circuits shall not be installed in the same raceway as the conductors for signaling line circuits unless written certification from the manufacturer is supplied to the Engineer indicating that the inclusion of these circuits in the same raceway is acceptable and that no additional consideration is needed for these circuits.

H. Notification appliance circuits and control equipment shall be arranged and installed so that loss of any one (1) notification appliance circuit shall not cause the loss of any other notification appliance circuit in the system.

I. Color coding of conductors shall be approved by the Owner. Unless otherwise indicated, the color code for all fire alarm system conductors shall be as follows:

1. Signaling line circuits and initiating device circuits shall be red and black. Red shall be positive and black shall be negative.

2. Audible notification appliance circuits shall be blue and white. Blue shall be positive and white shall be negative (NAC).

3. Sprinkler/standpipe circuits shall be red and black. Red shall be positive and black shall be negative.

4. Smoke detector power circuits shall be brown and violet. Violet shall be positive and brown shall be negative.

5. Auxiliary remote power supply circuits shall be brown and violet. Violet shall be positive and brown shall be negative.

6. Electro-magnetic door hold-open circuits shall be gray and gray.

7. HVAC shut-down circuits shall be orange and yellow.

8. Remote annunciator circuits shall be violet and numbered at each end.

9. Bond wires from the control unit to the master box ground rod, and all required bonding conductors shall be green.

10. AC supply circuit to the main FACU shall be white, black and red. The black shall be one phase, and the red shall be the opposite phase, if required. The white shall be the neutral. If a separate feed is required for the battery charger, it shall be black and white

unless the main FACU requires only one AC feed. In that case, the conductors to the battery charger shall be red and white.

J. Exposed raceways shall be run parallel and perpendicular to the walls and ceilings only in permitted areas. Raceway shall not be exposed in common corridors, and common spaces. Raceway shall only be exposed in mechanical spaces, electrical rooms, and storage spaces. Wherever practical, exposed raceways shall be run on the ceiling as close as possible to a wall or as high as possible on a wall. Where exposed raceways shall cross under a structural beam or rib, they shall be run down on one side of the beam or rib, across its bottom, and up to the ceiling on the other side of the beam or rib. No spanning from beam to beam or rib to rib shall be permitted. The use of a raceway body on one side of a beam or rib shall be permitted provided it shall be readily accessible.

K. Fault isolator modules shall be furnished as required and shall be mounted as directed by the manufacturer. The field location of the fault circuit isolators shall be labeled so that the devices may be easily located, and that location shall be noted on the point-to-point and as-built drawings.

L. The power employed to operate the fire alarm system shall have a high degree of reliability and capacity for the intended service. Connections to this power service shall be made on a dedicated branch circuit(s). The circuit shall be mechanically protected.

M. The electrical supply to the FACU shall be equipped with a dedicated fused disconnect with a handle that can be locked in the *"power on"* position. This disconnect is to be provided at the connection to the normal power supply serving the FACU. Circuit disconnecting means shall have a red marking, shall be accessible to authorized personnel, and shall be identified as "FIRE ALARM CIRCUIT CONTROL." The location of the circuit disconnecting means shall be permanently identified on a nameplate installed on the inside of the FACU.

N. All wiring within the control unit shall be neatly served in the panel gutters and be secured by means of Thomas & Betts "Ty-Raps" or by other approved means.

O. Where penetrations of floor slabs, fire-resistance rated walls and/or smoke barrier walls are made, the wiring shall be sleeved in metal raceway and the penetrations shall be fire-stopped with UL Listed through-penetration firestop assembly.

P. All signaling line circuits connecting remote control units and amplifier transponders on the network shall be wired Class A.

3.7 Identification

A. Provide "P-Touch", or approved equal, adhesive markers indicating the device address with minimum 12-point font lettering in the following locations:

1. Outside of addressable smoke detector bases.

2. Outside of addressable spot-type heat detector bases.

3. Outside of addressable manual fire alarm boxes.

4. Outside of addressable monitor modules.

5. Outside of addressable relay output modules.

6. Outside of addressable fault isolator modules.

B. See Part 3 “Wiring Installation” for identification of conductors.

3.8 Field Quality Control

A. Work shall be performed in accordance with the best and the most modern practices of the trade. The entire system shall be installed in a neat and workmanlike manner, in accordance with the standard instructions and recommendations of the manufacturer and in accordance with the approved manufacturer's wiring diagrams unless otherwise specifically permitted by the Owner and the Engineer.

B. The system shall be installed under the supervision of a qualified, trained, NICET (minimum Level III) Certified manufacturer's representative. The technical representative is expected to be on site with the Contractor during the installation of wiring and during the entire time of final connections and testing of the fire alarm system. The system shall be demonstrated to perform all of the functions as specified.

C. The supervisory work of the qualified manufacturer's technical representative shall include, but not necessarily be limited to, checking all the system wiring connections; advising the Contractor regarding technical details of the installation; and the adjustment and testing of all components of the system in order to ensure a complete and satisfactorily operable system. The manufacturer's technical representative shall be on site, as required by the Owner and the Engineer, during the entire installation and connection of the new control equipment. The technical representative shall monitor all wiring changes and assist the Contractor to ensure a smooth transition to the new control equipment. The cost of the technical representative shall be paid by the Contractor and shall be included in the bid price. The minimum amount of man-hours for this technical representative to be carried is 40 hours. The Contractor shall identify the amount of manufacturer’s technical representative’s man-hours that shall be provided and the per-hour cost (including the cost for possible overtime [premium] hours) for the technical representative’s time.

D. Perform Test to verify wiring is free from grounds and short circuit faults. Document and endorse results, and forward to the supplier, the Owner and the Engineer. No connections to the FACU shall be made until the system wiring has been accepted by the equipment supplier.

E. Perform inspections and tests required by NFPA 72-2010, "Inspection Testing and Maintenance" for control equipment, batteries, conductors, remote transmission, remote annunciators, initiating devices, notification appliances and auxiliary functions.

1. Replace system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained. Replace detectors that our outside their marked sensitivity range.

2. Use the NFPA 72-2010 "Record of Completion" to document the inspection and test results.

3.9 Cleaning and Protection

A. Do not install smoke detectors prior to substantial completion by other portions of the Work.

B. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit(s) internally using methods and materials recommended by manufacturer.

3.10 Equipment Removal

A. Completely remove all existing fire detection, alarm system control equipment, wiring and components and equipment. The equipment removed shall be boxed, labeled and delivered to the Owner. All unused, fire alarm system wire and cable shall be removed and disposed of properly off-site.

B. Perform all removal work efforts in accordance with the best and most modern practices.

3.11 Engineer Pre-Acceptance

A. Prepare and submit one (1) complete "Pre-Acceptance Documentation" submittal package to the Engineer a minimum of five (5) business days prior to proposed pre-acceptance test date. See Part 1 "Submittals" for submittal content. Resubmit portions or entirety of submittal to address Engineer comments prior to scheduling test date.

B. Schedule Pre-Acceptance Test with Owner, Engineer and related trades once submittal package was been reviewed to the satisfaction of the Engineer. Tests shall not be scheduled or conducted prior to satisfactory review of "Pre-Acceptance Documentation" submittal package.

C. Demonstrate system functional performance. Document testing results in the format specified by NFPA 72-2010 Figure 10.6.2.3; at a minimum, perform the following:

1. Functionally operate, in accordance with NFPA 72-2010, each fire alarm initiating device to ensure proper operation, correct annunciation at each remote annunciator (as shown on the drawings) and at the control unit and proper operation of all alarms and auxiliary functions. "Magnet" testing of smoke detectors will not be accepted as a functional test. A "wick/punk" source must be used in accordance with manufacturer's recommendations.

2. All manual fire alarm boxes shall be tested.

3. All auxiliary functions shall be tested including AHU shutdown and door hold-open deactivation.

4. All automatic extinguishing system switches shall be activated by flow of water.

5. All valves shall be mechanically operated. Valve supervisory switches shall be tested for change of state.

6. The signaling line circuits and the notification appliance circuits shall be opened in at least two locations per floor to check for the presence of correct supervisory circuitry.

7. The notification appliances shall be tested to automatically activate the audible and visible notification appliances throughout the building.

8. One-half of all tests shall be performed on battery standby power.

D. A 60-hour battery test shall be performed followed by a 5 minute alarm test period.

E. Reschedule testing where unsatisfactory results cannot be resolved such that testing can be completed during business hours on the scheduled day. See Owner "General Agreement" for possible additional costs and penalties.

F. Upon satisfactory completion of the Pre-Acceptance Test, leave the system operating for a minimum of one week prior to the Final Acceptance Test.

3.12 Authority Having Jurisdiction Final Acceptance

A. Prepare and submit a minimum of six (6) complete "Final Acceptance Documentation" submittal packages to the Engineer for review prior to submitting same to local officials for final system approval. Resubmit portions or entirety of submittal to address Engineer comments prior to submitting package to local officials. See Part 1 "Submittals" for submittal content.

B. Submit reviewed "Final Acceptance Documentation" submittal package to authority and coordinate scheduling (minimum ten (10) business days notice) of common fire sprinkler and fire alarm system acceptance testing. If acceptable to the authority, the reviewed "Approval Documentation" submittal may be submitted to the authority at the time of the final acceptance tests.

C. Coordinate with fire sprinkler portion of final acceptance tests. Operate as required.

D. Demonstrate system operations to authority having jurisdiction as necessary.

E. Reschedule testing where unsatisfactory results cannot be resolved such that testing can be completed to the satisfaction of the authorities. See Owner "General Agreement" for possible additional costs and penalties.

F. Upon satisfactory completion of the tests, leave the fire alarm system in proper working order.

3.13 Project Closeout Procedures

A. Prepare and submit a minimum of six (6) closeout documentation packages to the Engineer for review prior to scheduling Owner demonstration and training. Resubmit portions or entirety of submittal to address Engineer comments prior to scheduling demonstration and training. See Part 1 "Submittals" for submittal content.

B. Schedule Owner demonstration and training with the Owner for each building. Provide at least five (5) working days notice.

C. Demonstrate equipment, specialties, and accessories with the Owner. Review operating and maintenance information with the Owner.

1. Alarm Service Company & Building Manager: Prior to final acceptance of the fire alarm system, provide operation training to each shift of the Owner's designated Building Manager. Each training session shall be a minimum of 1 hour and shall be conducted on shift or at a time acceptable to the Owner. Each session shall include an overview of the system and the devices connected to it, emergency procedures (including alarm, trouble and supervisory condition procedures), control panel operation, and safety requirements. Each session shall include a complete demonstration of the system.

2. The manufacturer's technical representative shall also be required to instruct designated building and management personnel in the general operation of the system and to give the designated personnel an overview of the system functions when the system is in normal, supervisory mode, alarm mode, and trouble mode, as specified in this specification.

END OF SECTION 16720